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**ACTIVITIES OF
THE MARKETING AND FACILITIES RESEARCH BRANCH
DURING THE FISCAL YEAR ENDED JUNE 30, 1952**



**UNITED STATES DEPARTMENT OF AGRICULTURE
PRODUCTION AND MARKETING ADMINISTRATION
WASHINGTON, D. C.**



**ORGANIZATION OF THE
MARKETING AND FACILITIES RESEARCH BRANCH**

William C. Crow, Director
Budd A. Holt, Deputy Director

**MARKETING FACILITY PLANNING IN
SPECIFIC LOCALITIES**

C. J. Otten, In Charge

Develops plans and promotes the construction of the proper kinds of marketing facilities for all kinds of farm and food products at various stages in the marketing channel in specific localities; determines the type, size, location, design, cost, and method of financing and operation best suited for the specific locality; determines the financial soundness of the proposed facility; advises architects and builders before and during construction; and assists in getting the new facility properly operated.

**MARKETING FACILITY AND MATERIALS-
HANDLING PRINCIPLES**

W. H. Elliott, In Charge

Conducts studies to determine the principles that should be followed in ascertaining the proper size, layout, location, and method of financing and operating marketing facilities, and to determine the best kind or kinds of equipment for use in handling products at various stages in the marketing channel. The principles developed are followed in planning marketing facilities and equipment to fit specific localities and areas.

**TRANSPORTATION FACILITIES,
EQUIPMENT, AND LOADING
METHODS**

J. C. Winter, In Charge

Conducts research on transportation for all types of agricultural commodities, including but not restricted to studies and investigations of transportation facilities, methods, equipment, practices, and operations, and studies of transportation legislation, policies, and regulations in order to increase transportation efficiency, reduce costs, improve quality, and generally to expand the distribution of farm and food products.

**WHOLESALEING, RETAILING,
AND PACKAGING**

R. W. Hoecker, In Charge

Conducts research on merchandising, packaging, wholesaling, and retailing, in order to increase efficiency, reduce costs, improve quality and consumer acceptability, and generally to expand the distribution of farm and food products.

**MARKET NEWS AND GRADING
PROGRAMS**

K. J. McCallister, In Charge

Conducts studies and investigations to develop technical improvements which will increase the effectiveness of market news, inspection, and grading programs.

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ACTIVITIES OF THE MARKETING AND FACILITIES RESEARCH
BRANCH DURING THE FISCAL YEAR ENDED
JUNE 30, 1952

SUMMARY

The principal function of the Marketing and Facilities Research Branch is to find ways to improve the efficiency and hold down the costs of marketing farm and food products. Its work falls in the following broad fields: (1) Developing plans for and promoting the construction of the proper kinds of marketing facilities for handling farm and food products in producing areas, concentration points, and terminal and secondary markets; (2) determining the best kind or kinds of equipment for use in handling products at the various stages in the marketing channel and the methods of using such equipment that will reduce handling costs to a minimum; (3) improving transportation facilities, methods, equipment, practices, and operations in order to increase transportation efficiency, reduce costs, maintain quality, and expand the distribution of farm and food products; (4) finding improved methods of wholesaling, packaging, and retailing; and (5) developing improvements in the market news and grading services so that better information will be available to guide the marketing processes.

The Branch confines its activities to problems that cut across commodity lines. A large portion of the problems in the marketing field are common to many commodities. In dealing with such problems, the work can be done most efficiently by working on a cross-commodity basis rather than by making separate studies of the problem for each commodity. Furthermore, in many situations conditions cannot be changed for one commodity without changing them for a number of others. Transportation facilities, for instance, must be planned and used to accommodate many commodities. Wholesale market facilities handle a great variety of commodities purchased by retail stores. The kind of materials-handling equipment needed for handling the various kinds of farm and food products depends largely on the nature of the marketing facility, the size and weight of the package, and the volume handled rather than upon the commodity contained in the package. Retail stores that handle several thousand items cannot be concerned to any great degree with a single commodity in developing improvements in their operations. In dealing with many marketing problems, results that have been developed by means of research on one commodity can be applied, with very little adaptation, to the other commodities and commodity groups. For these reasons there is a need for cross-commodity work in numerous places in the marketing channel where the commodity involved is not the primary cause for investigation or where the action taken will affect many commodities.

The improvements in marketing efficiency that result from this program are bringing better returns to farmers, providing consumers with higher quality products at more reasonable prices, and enabling the private marketing system to do a more efficient job of taking to the consumers of the Nation the products that can be produced in such great abundance on its farms. Although practically all the work in this field is of recent origin (having started with the passage of the Agricultural Marketing Act of 1946), the research program of the Branch during the past year

produced many important findings which were widely accepted throughout the marketing system. The demand for assistance from the Branch in finding answers to specific marketing problems and situations was greater than it has ever been before. Hundreds of marketing firms and institutions offered full use of their facilities for the conduct of research programs. No work was conducted except in response to specific requests from marketing organizations, trade groups, and other persons and institutions engaged in marketing. Nearly all the work has been conducted in close cooperation with marketing organizations. The laboratory for the conduct of the research program has been the facilities of individuals and firms engaged in marketing, and results of the work have promptly been made available for public use.

Recognizing that research is of value only if the results are applied, during the year the Branch published 26 research bulletins, prepared a large number of articles for marketing publications, and presented its findings at many meetings of trade and farm groups. Members of the staff of the Branch, upon request, participated in short courses and other meetings for the purpose of explaining the results of the research and aiding in their application. The year closed with studies under way that are expected to result in the publication of more than 40 bulletins during the coming fiscal year. Although no organized effort has been made to determine the full extent to which the findings of the Branch are being applied in improving the marketing system, it is known that the improved methods developed have been widely adopted, in some cases by thousands of firms.

Practically all the work of the Branch during the year was carried on in cooperation with other agencies and groups concerned with marketing, including State Departments of Agriculture and Bureaus of Markets, State agricultural colleges, municipalities, trade and farm organizations, transportation agencies, equipment manufacturers, engineering firms--in short, a large portion of the organizations concerned with improving the efficiency of distribution.

This summary of the activities of the Branch for fiscal year 1952 has been prepared in order to record the work that was done. At the end of this report will be found a list of the recent publications of the Branch. These publications, of course, report more fully on the individual projects that are discussed herein.

MARKETING FACILITIES PLANNED

The provision of proper marketing facilities for handling farm and food products results in increased income to farmers, facilitates the obtaining of supplies by retailers, reduces the cost of operation of other middlemen, and places a greater variety of products in the hands of consumers in better condition and at lower prices. Since properly planned facilities have direct rail connections, wide streets, and parking areas, their construction is also beneficial to transportation agencies. The elimination of handling and provisions for necessary refrigeration reduce spoilage and deterioration of products as they flow through the marketing channel. Thus, many groups are interested in improving marketing facilities.

During the year the Branch assisted 25 cities or areas and gave advice to several other localities in determining the kinds of marketing facilities needed for the efficient handling of food products or in bringing about the construction and operation of such facilities. New wholesale produce markets in San Antonio, Tex., and Columbia, S. C., planned in previous years, were opened for business in the fall of 1951, and by the end of the year the markets under construction in Hartford and St. Louis were almost completed. These four markets cost about \$10,000,000 and by operating in them annual savings in distribution costs are expected to exceed \$2,000,000. In these 4 markets there will be facilities for handling foods at wholesale by farmers, dealers, and truckers. These facilities will consist of store buildings, farmers and truckers' sheds, railroad tracks, adequate parking spaces, and areas for expansion. Improvements were made in the markets at Winston-Salem, N. C., and Benton Harbor, Mich., and construction of new facilities in Indianapolis and Boston has just begun. The completion of the facilities currently under construction will bring to 18 the total number of improved market facilities that have been built since this program of assistance began. Studies have been made and plans developed for about 23 other localities where construction has not yet started. In a number of these places, substantial progress is being made toward the carrying out of plans recommended. In Nashville, Tenn., for instance, land has been purchased for the construction of the recommended facilities. In San Juan, P. R., more than 4 million dollars has been made available for dredging the channel, for building bulkheads and docks, and for the preparation of the site recommended for central market facilities, which will include warehouses, wholesale stores, a meat packing plant, grain elevator, oil-extracting facilities, feed-mixing plant, and a public retail market. In both Savannah and Houston plans have progressed to the stage where it is expected that a contract for construction will be signed by the end of July 1952. The year ended with requests for assistance on hand from 24 other localities.

New market facility studies were conducted during the year in 9 localities. It should be pointed out that all these studies for the purpose of developing plans for adequate marketing facilities were made on the basis of requests from the specific localities and with the active cooperation of the groups concerned. In every instance the object of the study was to develop facilities that will eliminate all unnecessary handling operations, reduce the cost of performing those operations that are necessary, maintain the quality of the products being handled, and otherwise facilitate the movement of farm and food products through the marketing channel. In localities where studies indicate that the construction of new facilities will not bring sufficient advantages to make the investment self-liquidating and produce savings in the cost of distribution, it is recommended that no facilities be built. When studies indicate that satisfactory results can be achieved by improving existing facilities at reasonable cost, such improvements are recommended rather than proposing that existing facilities be abandoned and new facilities created in a different location.

It is interesting to note that although there has been more construction of marketing facilities during the past year than at any time since this program began, there has been little or no difficulty in obtaining the materials necessary for this construction. Wholesale food marketing facilities consist mostly of one-story

buildings and open sheds. Such structures can be built from any one of a variety of materials; therefore large quantities of materials in short supply are not needed. Under such conditions the economies in labor and materials and savings in food supplies effected from the construction of satisfactory facilities far outweigh the small amount of materials in short supply required for their construction.

STUDIES TO DETERMINE HOW TO PLAN SUCCESSFUL MARKETING FACILITIES

Several studies were undertaken to determine the principles, standards, and criteria that should be followed in developing the proper layout, design, size, location, method of financing, method of operating, and other factors essential to the success of various types of marketing facilities. The results of these more general studies are used not only by the people in the Branch who are planning marketing facilities in specific localities but also by persons and places which the Branch is not in a position to assist directly.

One of these studies completed during the year determined the factors that are essential to the success of assembly markets for fruits and vegetables in producing areas. This study shows that the daily volume of produce offered for sale is the most important factor in attracting buyers and in insuring the success of markets of this type. For average value produce the minimum daily volume required is roughly 1,800 packages, or about 3.6 equivalent carloads. For high unit value products, such as strawberries, about 900 packages daily is the minimum. Another study developed criteria for use in determining whether or not a country elevator should be built in a particular area and what location, capacity, size, layout, construction, and method of operation would be most suitable. A third completed study provides criteria for wholesale frozen food distributors to use in planning efficient facilities and performing order-assembly operations. Other studies on which work was done during the year were designed to: (1) Determine the proper layout, design, and method of operating livestock auction markets; (2) develop the principles that should be used in planning the kinds of facilities and equipment needed to handle tobacco efficiently; (3) determine the kind of facilities and equipment that will most efficiently handle eggs in producing areas; and (4) find out what types of ownership and methods of financing wholesale produce markets are best for varying situations.

Even though a large part of the marketing operation consists of handling products through a succession of facilities in the marketing channel, until the passage of the Agricultural Marketing Act of 1946 little work had been done to assist in the planning of efficient marketing facilities, and such investigations as had been made resulted largely in the issuance of reports deploring the conditions that were found. Although there has been a tremendous demand for assistance in planning facilities to meet the specific needs of particular localities, the developing of plans without a thorough knowledge of the principles that should be

followed and the criteria that should be used in developing them would be a dangerous undertaking. For these reasons as many studies as possible have been made to find out precisely how to plan successful marketing facilities for all kinds of farm and food products under all kinds of conditions.

IMPROVING HANDLING METHODS AND EQUIPMENT

For the marketing system to be efficient it is necessary not only to have the right kind of facilities throughout the marketing system but also to have the right kinds of equipment to move commodities into, within, and out of these facilities and to use such equipment properly. The equipment used must be suited to the facility, and the facility must be so designed that the right kind of equipment can be used in it. More than half the total cost of marketing goes to pay the wages of labor. It is estimated that for industry as a whole 32 percent of the total labor employed is used for handling materials--unloading from railroad cars or trucks, moving into storage or to assembly lines, moving the product out of storage, etc. In a number of food-handling industries, such as in the warehouses of wholesale distributors and public warehouses, nearly all the labor employed is used for the physical handling of products. Many operators in the food marketing system receive and ship out products in the original package. Since they do nothing to change the form of the product itself, their operations consist almost entirely of handling the products. For many operators who grade, pack, and repack commodities materials-handling operations constitute one of their principal items of cost. With increasing wage rates and shortages of labor there is growing pressure to provide labor with the types of equipment that will increase its productivity. Unless unnecessary handling operations are eliminated and labor in the marketing channel can be made more productive, it probably will be impossible to halt the trend toward higher marketing costs, with higher prices to consumers and lower returns to growers.

The Branch is conducting a number of research projects to find ways of increasing the efficiency of materials-handling operations at various places in the marketing channel to reduce costs, conserve manpower, and decrease waste and spoilage. This work involves: (1) Determining the comparative efficiency of various types or combinations of types of materials-handling equipment and methods, and promoting the use of the most efficient types and methods; (2) developing improved methods and types of equipment for performing specific operations; (3) determining the proper amounts of equipment for enterprisers of various sizes; and (4) determining the comparative space utilization in facilities when different types or combinations of types of equipment are used.

During the year materials-handling studies were carried on in four categories: (1) Stores and warehouses of wholesale fruit and vegetable distributors, (2) commercial apple packing and storage houses, (3) public refrigerated warehouses, and (4) cotton warehouses. In two of these fields work was being carried on by personnel of the Branch, while in the other two it was being conducted under contract. Case studies have been made of the handling of fruits and vegetables in a number of wholesale stores to find improved methods of handling products into, within, and out

of these stores. As improved methods were developed, reports were prepared and issued. The work in wholesale produce houses can be illustrated by one study, completed during the year, which analyzed the cost of loading delivery trucks of service wholesalers by six methods currently used. This study showed that this operation could be done for as little as \$1.43 per ton with one method while costing \$2.27 with another.

In the commercial apple packing and storage warehouses of the Pacific Northwest case studies were conducted in 17 houses in the State of Washington to determine the relative merits of different kinds of handling equipment and methods and to develop new methods and equipment which would reduce handling costs. One phase of this study that was completed during the year showed how some operators can reduce their cost of receiving apples by as much as 80 percent by use of the proper kinds of equipment and methods. The most costly method of receiving apples was found to be by use of belt conveyors and clamp-type two-wheel hand trucks, while the lowest cost method used pallets and industrial fork-lift trucks. Another result of this study was the development and testing of a portable mechanical lift for high-piling and breaking out high-piled boxes of apples. By use of this lift the cost of high-piling was reduced by more than half, and the cost of breaking out the boxes from the stacks was reduced by about 75 percent. In order to present the results of this study to operators of apple packing houses, short reports on specific operations and a complete report are being released. In addition, a 28-minute movie was made which shows clearly the difference between the efficient and the inefficient methods and equipment. During the 2 months that the movie has been available, it has been viewed by more than 500 apple house operators.

In order to determine the relative costs of handling products into, within, and out of single- and multiple-story warehouses, to determine the best methods of handling in both single- and multiple-story houses, and to find out the cost of stacking products varying heights, a study is being made of handling products into, within, and out of public refrigerated warehouses. The collection of data for this study was completed during the year, and a report is being prepared which will:

- (1) Assist persons who are planning new warehouses in developing an efficient design,
- (2) show the best kind of handling equipment to use in such warehouses, and
- (3) set forth some ways that operators of existing warehouses can reduce their costs of handling.

The study of materials handling in cotton warehouses has as its objective finding the most efficient ways of handling cotton into, within, and out of warehouses, where much manual labor has been used in the past. Several interim reports presenting results of these studies have already been issued. During the year another report, entitled *Some Improved Methods for Receiving Bales of Cotton in Compresses and Warehouses*, was released. This report brought together and unified in a single publication a number of improved cotton-handling methods, including unloading railroad cars and motor trucks by industrial lift trucks; employment of temporary or "floating" blocks of bales between the various operations; use of a mobile beam scale for weighing flat bales, and powered equipment for transporting bales; "block sampling" of flat bales; and an improved method for integrating the weighing and sampling of compressed bales. The nature of the results of this study can be illustrated by pointing out that the proper employment of clamp trucks for

unloading motortrucks from ground level or railroad cars from platform level could reduce the man-hour requirements to about one-sixth of that required when hand trucks are used. A report to serve as a guide to cotton warehouse managers and foremen in improving their handling operations has been prepared and will be published during the next fiscal year.

Another project in the field of increasing the efficiency of labor is one the purpose of which is to find ways of reducing the amount of labor required in sorting for grade, through visual inspection, various types of agricultural commodities without sacrificing accuracy. This objective is being achieved by determining: (1) The optimum speed for running products over grading belts or tables and rotating the products, (2) the comparative efficiency of single- and multiple-row arrangements for the translation and rotation of the products, and (3) the proper direction of approach of products to the grader. Although the project had not been completed at the end of the year, the methods and equipment developed in the laboratory had been tried out in packing sheds handling lemons and oranges, with the result that it was possible to grade lemons with 25 percent of the labor required in the usual method and oranges with 33 percent of the former labor requirements. These savings in labor were accomplished without any change in the degree of accuracy of the grading process. Since grading is, for a number of products, one of the operations in the packing line which requires relatively large labor inputs, the development of methods which will reduce the amount of labor should be of material assistance in improving the entire packing operation.

WORK ON WHOLESALING, RETAILING, AND PACKAGING

In the fields of wholesaling, retailing, and packaging, research has been conducted in close cooperation with many individual retail and wholesale establishments and with three national trade organizations. All work done in these fields has been upon the recommendation of industry advisory committees and has had as its objective finding ways to reduce the cost of performing these operations. Retailing alone usually accounts for about one-third the total marketing bill, and it is in the retail store that the consumer decides whether to take the product or leave it. Thus improvements in retailing are important not only to retailers but also to consumers and farmers.

In a previous report it was pointed out that the Branch had developed a new check-out counter, the use of which made possible an increase in the rate of the check-out operation by about 38 percent. Although no effort has been made to determine the full extent of the adoption of this counter, it is known that by the end of June 1952 more than 3,000 were in use. The experience gained with this counter has made it possible to develop further improvements. As the year ended, the Branch was in the process of constructing a counter with these improvements, preparatory to trying it out under actual operating conditions.

A study has been completed which developed more efficient methods of receiving, price marking, and stocking shelves of retail grocery stores, and a report entitled *Some Improved Methods of Handling Groceries in Self-Service Retail Food Stores* was issued. The improved methods and equipment resulted in increased productivity

ranging from 67 to 87 percent in the stores where the study was conducted. The most productive method of receiving was by use of wheel-type gravity conveyors. Checking the order in and unit pricing each case after the order had been stacked and segregated by commodity groups in the storeroom was more productive than former methods. The most productive price-marking system analyzed was the stamping of prices on the items at the shelves by means of a self-inking price-marking set attached to the handle end of each four-wheel stocking truck. Cases to be stocked on the bottom shelf were removed from the truck to the floor, while those to be stocked on the middle and top shelves were price marked and stocked directly from the truck. The highest production per man-hour for stocking the shelves was obtained by use of four-wheel hand trucks for carrying cases from the storeroom to the shelves and using a new leaf-type sliding shelf to support the merchandise during the shelving operation.

The major work done in the retailing field during the year consisted of a study to develop improved methods, equipment, materials, and layout in retail meat departments in order to increase labor productivity. The purpose of this study was to find the most efficient methods of handling meat in service meat departments and of pre-packaging and handling in self-service departments. By the end of the year this study was almost completed, and five publications were being written setting forth the results of various phases of the work. Improved methods of handling have been developed, as well as improved materials and new equipment. Among the new types of equipment developed in the study were a device which can be attached to the power saw for removing bone dust from the meat as it is cut, a meat hook stabilizer for holding meat rigid on the rail in order to permit blocking in that position, and a simple device to remove the spinal cord. Before the end of the year several meat departments were redesigned in accordance with the improvements developed in the study, and the over-all productivity of labor in these departments was increased by more than 40 percent.

To assist retailers in reducing the cost of rewrapping prepackaged meats, poultry, and cheese, a study was completed and a report released on *Costs of and Reasons for Rewrapping Prepackaged Meats, Poultry, and Cheese*. The average cost of rewrapping was found to be 2.7 cents per package. The principal causes of rewrapping were price changes, unattractive packaging, discoloration, and broken film. Some of the ways of reducing the amount of rewrapping necessary were found to be maintenance of a high rate of turn-over, using outside labels or changing the label by slitting the film, better use of refrigeration, reduction of the amount of light exposure, better trimming and wrapping, the use of trays for certain cuts, removal of sharp bones, and allowing free fluids to drain before packaging.

In order to obtain more efficient utilization of shelf space in retail stores, a study was conducted to compare the sales of 17 selected canned fruit and vegetable items from 2-, 3-, 4-, 5-, and 6-row displays. The results showed an average change in sales of about 10 percent for each row added or taken from an item display. The average sales and gross margin per unit of display space with a 2-row display was about 5 times as great as the sales or gross margin per added unit. The results of this experiment were applied to two supermarkets, with savings in shelf space of 36 and 41 percent and increases in average gross margin per shelf foot of 74 and 82 cents.

A study was started to determine the effect on store sales of special item displays, the relative returns per square foot of selling space of the special displays compared to shelf displays, the relative effectiveness of multiple-item displays, the effective life of the displays tested, and the carry-over effect on sales of special displays.

In cooperation with two national organizations of wholesalers, studies were made to determine ways in which wholesalers and retailers can cooperate to increase their combined efficiency and lower food distribution costs, and two reports were issued. One of these sets forth some methods which leading wholesalers are using in helping retailers sell more groceries at lower costs through use of informational and promotional aids, store engineering and store management guidance, accounting assistance, retail training, financial aid, real estate advice, and insurance service. The other report shows how some wholesalers are holding down the cost of taking and filling orders and making deliveries. The best ways that were found for holding down the cost of taking orders were by using pre-printed order forms, increasing the size of orders, and eliminating calls for unprofitable orders. Order assembly was made more efficient through proper stock arrangements and the use of the right kinds of equipment. Delivery costs were reduced by decreasing the number of deliveries, improved truck routing, making some use of common carriers, and reducing the time spent in truck unloading. In the course of this study a procedure was developed for more accurately measuring the performance of drivers which, when put to use, decreased the drivers' time by more than 10 percent. As the year closed, the retail customers of the wholesalers chosen for the case studies were being surveyed to determine which services of wholesalers are of greatest value to them, what suggestions they have for improving wholesaler-retailer cooperation, and whether or not they would accept certain proposals for reducing operating costs.

One of the principal problems faced by retailers is that of training employees. In view of the large turn-over among these workers and the difficulty of recruiting experienced people, it is particularly important that satisfactory training methods be developed. Observations of the Branch on the introduction into retail establishments of some of its improved methods and equipment, such as the new check-out counter, show that in some establishments the equipment and methods are used in the proper manner, bringing the expected results, while in others months pass without the employees making proper use of the new equipment and methods. Obviously the full benefits of new equipment and methods will not be obtained unless employees are adequately instructed and motivated. Upon the suggestion of the industry advisory committee research has been started to develop better techniques for training retail food store employees and to determine the relative effectiveness of improved training methods. This research is being conducted in cooperation with two groups of supermarkets. In one of these organizations present training practices were determined and their effectiveness measured, modifications of the existing practices were made, some of the employees were trained by the use of old methods and others by the new, and the training results measured. Preliminary analysis of the data indicates that significant gains can be achieved in productivity, accuracy, and employee satisfaction through the improved training techniques tested. Research with the second group of supermarkets has been started, but the collection of data has not been completed.

TRANSPORTATION FACILITIES, EQUIPMENT, AND LOADING METHODS

Research in the transportation of agricultural commodities followed three general lines of work: (1) Better utilization of carrier equipment, (2) improvement of the various types of transportation equipment and of the facilities for loading and unloading, and (3) development of better stowing, bracing, and shipping methods, including a study of the use of palletized containers.

In an effort to get improved utilization of railroad equipment, the results of a study of the records of movement of 36,000 carloads of agricultural freight and a formula developed during this study for measuring the relationship between standing time and moving time of loaded cars were transmitted to the presidents of approximately one-half of the Class I railroads in the country for their review and adaptation to their operations. The officials of many of these railroads have displayed considerable interest in the study, and several are taking steps to evaluate terminal delays on their lines. The importance of the study is further indicated by the fact that the problem of terminal delays is actively being studied by the American Railway Engineering Association, an affiliate of the Association of American Railroads. It has set up a committee to make a continuous study and requested participation of the Branch. It has invited a member of the staff of the Branch to become a member of the Association to work actively with it.

Considerable work was done during the year in an effort to develop improved methods of protecting perishable agricultural products from heat and cold while they are being transported. A test was made of a new method of dry ice refrigeration in which a car equipped with a dry ice system of refrigeration, with only one moving part (a float valve), was held for 10 days with an outside temperature of 85°. The bunker was loaded with 12,000 pounds of dry ice, which held satisfactory temperatures for the 10-day period with no re-icing. This test indicated that from the standpoint of temperature maintenance dry ice refrigeration was on par with mechanical methods of refrigeration. However, the cost of the amount of dry ice used was calculated at \$437.32 compared to a tariff rate of only \$158.70 for similar service using water ice and salt, or a mechanical unit for refrigeration purposes. A further result of this laboratory test has been the adaptation of this system of refrigeration by the refrigeration equipment manufacturer to motortruck trailers in accordance with the standards and specifications of design and construction recommended by this Branch. This pilot refrigerated trailer unit will be ready for road tests in August 1952.

Three transportation tests on fresh and frozen meats by rail have been conducted on products moving from midwestern packing plants to the eastern coast.

Work was continued to provide uniform temperatures at 0° for frozen foods transported in refrigerator cars by the application of different methods of refrigeration. Experiments were made with two types of mechanical refrigeration--one car equipped with gasoline-powered units which delivered cold air into the car under the floor racks, and the other operated by a single diesel engine which delivered the cold air over the top of the load.

Additional tests were made on the transportation of frozen foods by refrigerated motortrucks. In a number of cases it was found that the mechanically refrigerated

units had ample capacity, but that due to inadequate floor and wall racks the cold air could not circulate completely around the load. This was corrected by the use of a return air duct and modification in the method of loading. Three transportation tests were made of shipments of frozen poultry moving by motortrucks from the Eastern Shore of Maryland to Chicago and Detroit. Standard stainless steel trailers equipped with mechanical refrigerating units were used in these tests. One trailer was loaded and refrigerated in the conventional manner, and the other equipped with a return air duct using a modified method of loading. It was found that the temperature in the latter trailer averaged about 4 degrees colder than the other. As a result of these tests one of the largest poultry processors in the country has requested the motor carriers hauling its product to install return air ducts in their equipment and use the modified method of loading. An interim report of this study has been published for use by other poultry processors and motor carriers in converting their equipment. The results of the over-all test program and recommendations for improved refrigeration methods were reported in several publications.

Considerable progress was made in developing a handbook of facts which will show the proper methods of transporting various agricultural commodities by motor-trucks. This publication will deal with such subjects as precooling, loading methods, transit temperatures, and other factors essential to the proper protection of the products.

A study of the transportation of grain by motortruck in the Southwest was completed and a report published. The report shows that the percentage of grain trucked by 117 elevators and mills ranged from 33 percent for country elevators to 16 percent for feed mills. The analysis showed that truck rates were substantially lower than rail rates between identical points, in some cases by as much as 50 percent. This study showed that the principal reasons that shippers are using truck transportation in preference to rail were lower rates, better service, shortages of boxcars, lower handling costs, and the need to increase the volume of grain shipped. The report also points up improvements needed and desired by shippers in the movement of grain by rail. There is widespread interest in the report by the grain trade, equipment manufacturers, and transportation agencies. Upon the completion of this report attention was shifted to developing an improved boxcar design and low-cost boxcar unloading equipment for the handling of grain. Contacts have been made with equipment manufacturers, and satisfactory progress has been made in obtaining their cooperation in designing the proposed new equipment.

The relatively large amounts of loss and damage suffered by many perishable agricultural commodities from mechanical injury during transportation is one of the major factors contributing to the comparatively high cost of marketing and transporting these products. The Branch conducted several studies in an attempt to reduce the loss and damage during transportation by improving loading, bracing, and shipping methods. The new container for lettuce and carrots, the development of which was described in last year's annual report, has almost entirely replaced the other three containers formerly used for the shipment of these commodities from western producing areas. A check made of the performance of the new container in the first year of usage under actual commercial conditions showed that the previous test results were borne out in the ability of the new crate to reduce transit damage.

During the year approximately 1,700 cars of cantaloups were shipped with the on-end method of loading developed earlier. The results of shipping these cars showed that breakage was reduced by about two-thirds and bruising by about one-half as compared with the lengthwise method of loading which has heretofore been used. In the research during this year emphasis was placed on finding easier, less expensive ways of loading, stripping, and bracing the on-end loads, and the results of the work have been released in an interim report.

Work was started on the problems of packing and shipping broccoli and cauliflower, with emphasis being placed on finding methods of reducing the loading costs and providing better protection of the commodity through more effective use of top ice. Adequate amounts of top ice in loads of broccoli, cauliflower, lettuce, and some other commodities will help prevent breakage in transit by holding the containers in place. A series of test shipments of broccoli in which no crosswise strips were used reveals that the commodity could be shipped in this manner with no more breakage than with the usual method and with some savings in labor and material costs. Most of the work on cauliflower was aimed at the feasibility of using different types of containers to reduce transportation costs and the closer trimming of the heavy jacket leaves around the curd in such a way as to reduce the container and refrigeration costs per net pound of commodity shipped. More than 2,000 heads of cauliflower were measured during the season to serve as a basis for considering changes in crate dimensions. Several transcontinental shipments of the commodity were completed. Research on the transportation of celery, initiated during the previous year, was continued during the shipping season in the fall of 1951, and eight transcontinental test shipments were made. In connection with the more than 140 shipping tests on various commodities made under this program during the year, a detailed check was made of the amount and type of damage and container or load failures in each shipment. This information, which is now being cataloged and analyzed, will provide a basis for recommended changes in containers and loading and bracing methods.

Research aimed at determining the relationship between loss and damage in rail shipments of dressed beef and the relative amounts of shock and vibration received in transit was completed. The information developed in the test shipments, together with that developed in a previous survey of the loss and damage occurring in 3,400 cars, has been incorporated in a report which is in the process of publication. This report shows the amount of damage, the causes of the damage, and some of the steps that can be taken to reduce it.

Work was continued in an effort to determine the feasibility of using large, collapsible, reusable, pallet-type master containers to reduce the damage and handling costs now associated with the transportation of consumer-size bags of various commodities. Several truck tests and one rail test of large, collapsible, wire containers were run in the spring of 1951. After these tests the type of container was changed, and test models of a new container using wood veneer and wirebound construction were made in the spring of 1952. Although the new containers were not entirely satisfactory, they did carry the products to market in excellent condition and effected some savings in labor and other costs of loading and unloading. After further changes are made in the containers, additional test shipments will be run.

STUDIES TO IMPROVE MARKET NEWS AND GRADING

Two of the oldest marketing programs of the Department are the market news and grading services, which have been in operation since World War I. Since they were established many changes have taken place in the marketing system, methods of transportation and communication, marketing practices, marketing channels, and areas of production. In order that these programs may continue to give good service to this changing marketing system, they must be modified from time to time to meet the changing conditions. To assist in making these improvements, three types of work were carried on during the year: (1) Studies to improve the effectiveness of the wholesale market news service, (2) the completion of a report analyzing the possibility of developing useful retail market news information, and (3) work on the adequacy of grades and standards. These activities were carried on in close cooperation with the Office of the Assistant Administrator for Marketing and the Market News Divisions of the commodity branches in order that the investigations might be aimed at finding answers to the most pressing problems and that full use might be made of the personnel engaged in performing these services.

The analysis was completed and a report published on the practicability and usefulness of market news reporting of prices received by creameries for butter. This study was undertaken because of the need for finding a better basis for reporting butter prices than is available in the terminal market reports. The study revealed that there were wide variations in prices received by creameries for the same grade of butter, and that in many instances Grade B butter returned more than Grade A. The creameries found that the market information sent to them on a trial basis during this study was useful in determining the adequacy of their returns, in bargaining for better selling terms, in establishing prices for butter in their specific location, and in making many other decisions.

Four reports were prepared during the year which list in detail the kinds of market news information being published by markets and areas for shell eggs, live poultry, dressed poultry, and dairy products other than butter and cheese. They show the basis for reporting being used in each market and reveal many opportunities for bringing about greater uniformity in market news reporting between markets.

Three reports were completed in cooperation with the Iowa State College on the study to determine the effectiveness of different means of disseminating market news information to farmers. One of these reports shows how farmers in Iowa obtain and use market news. The second shows the extent to which they depend on radio for market information and the changes that they would like in the information being supplied them. The third shows the extent to which farmers obtain the market news from newspapers and what additional information they would like from this medium. The information contained in these reports will be useful in helping get to farmers the kind of information that they need.

A tabulation was made of all the agricultural market news information carried in 1,765 daily English-language newspapers in the United States. The results were studied to determine the extent that daily newspapers were using market news and the kind of distribution that is being given to market news prepared in each Federal and

Federal-State office. It was found that the value of total space devoted to market news information of the Department amounted to about \$5,700,000 per year. As a result of this study two publications were prepared for use by Federal and Federal-State market news services and newspaper editors in improving newspaper distribution of market information. One showed the distribution of this information by market news offices, by States, and the other was a directory of newspapers showing the kinds of market news carried by each.

In cooperation with the University of Arkansas, a study was undertaken to develop and test the practicability of reporting local feed market news information for use by farmers in the purchase of feed. During the year a comprehensive survey of feed dealers was completed, and trial reporting of feed supply conditions and prices was undertaken in the two principal livestock and poultry feed areas in the State.

In response to numerous requests from the poultry industry for improved market news reporting of broilers and fryers, a study was undertaken of the accuracy and usefulness of the information being reported and the need for changes in the present service. During the year 25 poultry plant operators and buyers, 20 feed dealers, and 50 farmers were interviewed in the North Carolina producing area, and 30 plant operators and buyers, 30 feed dealers, and 50 producers in the Shenandoah Valley area of Virginia and West Virginia. Records were obtained on prices paid farmers for comparison with market news prices for the same day, and all members of the industry were asked to comment on the usefulness of the present information and the need for different or additional information. These surveys will be continued in other major broiler-producing areas, and a report prepared on the market news needs of each area.

The report on the possibilities of using retail market news reporting as an aid in marketing was completed and published. This report was based on an experimental market news service in Baltimore and the experiences of State and city governments in reporting retail market news in Providence, Boston, New York, and Baltimore. The report showed that there were many and sometimes large maladjustments between wholesale and retail prices that hindered the effective marketing of farm products. It also showed that retail market news, when reported along with wholesale market news, could help to reduce these maladjustments. The experimental retail market news reports prepared in Baltimore were used by 84 percent of the retail grocers who received them. These grocers stated that with the report they were better able to keep up to date with competitive price changes on the large number of commodities they handled and were better prepared to determine what price they could afford to pay. Fifty-five percent of a representative sample of homemakers stated that they used the information in the reports in their buying, and that as a result of the information they substantially increased their purchases of items that were shown to be the best values. The survey showed that 49 percent of the Baltimore wholesalers, 39 percent of the processors, 28 percent of shippers to Baltimore, and 4 percent of Maryland and Virginia farmers who received the report made use of the information contained therein. It was found that it would cost approximately \$21,000 a year to report accurate retail prices on the major food commodities in a city the size of Baltimore.

In cooperation with officials responsible for the development of U. S. standards, a review and analysis were made of the principles and practices followed by the Department in the development of standards for agricultural products, and a report was published which set forth for the first time the principles and practices being used. There are about 400 standards for grades of individual products promulgated by the Department of Agriculture. A directory, prepared in 1948, listing all these standards and the terms used to indicate each grade was brought up to date during this year. This revision brought out the fact that more letters and fewer numbers and terms were being used to designate grades, and that there has been a reduction in the number of grades for many commodities.

REACTIONS OF THE ADVISORY COMMITTEES TO THE WORK

Nearly all the work that the Branch has done during the year was in compliance with recommendations of the industry advisory committees established under the Agricultural Marketing Act of 1946. Hence the results of the work, the methods being used, the progress being made, and the plans for the future were presented to the advisory committees concerned and their criticisms and suggestions were requested in order to take full advantage of their guidance in the conduct of the work. At the most recent series of advisory committee meetings 15 committees made 68 recommendations for continuation or expansion of projects being carried on in this Branch or for the inauguration of new work in the field assigned to it. Insofar as resources are available, the recommendations of these committees will be followed in the conduct of the program for the coming fiscal year. In addition to the valuable assistance being received from these advisory committees, several groups engaged in marketing have set up their own informal advisory committees to work with the Branch in the conduct of specific research studies affecting them. The assistance from such committees not only has facilitated the conduct of the work but also has aided in bringing about the adoption by industry of the results of the research. The Branch will continue to concentrate its efforts on finding solutions to problems that are of real concern to persons engaged in marketing, emphasizing work that will hold down the cost of distribution and make the marketing process more efficient.

PLANNING MARKETING FACILITIES IN SPECIFIC LOCALITIES

As farm and food products pass through the marketing channel, they move through one type of facility after another from the farm to the consumer. The number of facilities through which they move and the efficiency of handling within those facilities have a great deal to do with the cost of marketing. The absence of needed facilities deprives farmers of satisfactory outlets for their products. Hence, in order to move the maximum quantity of farm and food products through the marketing channel at the lowest possible cost and with a minimum of deterioration and spoilage, efficient marketing facilities must exist in all places where they are needed. There are many types of marketing facilities in producing areas, concentration points, and terminal and secondary markets, the type depending largely on the function performed and, to a lesser extent, on the commodity handled.

Marketing facilities in producing areas may consist of packing sheds, assembly markets, processing plants, or some other type of facility to which products of many farms are brought together for preparation and shipment to more distant markets. The facilities in the large wholesale or terminal markets usually consist of stores for wholesalers, storage houses, sheds for farmers and truckers, railroad tracks, and other facilities for bringing together, displaying, and selling a wide variety of products coming from all parts of the country. From these terminal markets the products may move through secondary markets equipped with jobbers' facilities or may go directly to retail stores. For the marketing system to be efficient the facilities at each of these points must be so designed and operated that they will perform their function at the lowest possible cost. In many localities market facilities are inefficient and are not satisfactorily performing their function. In some places they lack rail connections for direct loading or unloading between railroad cars and the buildings. In others the design of the facility is such that efficient handling is impossible. In many cases, because of insufficient space it has been impossible to provide the facilities to meet the needs, and the market structure has broken down with the products flowing through several different wholesale market locations. In some markets the absence of wide streets and adequate parking areas produces serious traffic congestion. Many establishments lack the necessary refrigeration and handling equipment to provide proper care for the commodity. Often buildings are not large enough to accommodate the commodities which should move through them. Thus the marketing facility problem in any locality may be one of providing facilities where none exist, improving existing facilities, or consolidating, relocating, and rebuilding them in a new location. Proper facilities for a specific area can be developed only after a careful study of existing facilities and needs of the locality.

The inefficiency of marketing facilities for farm and food products, with the excessive costs of distribution that result therefrom, has been the subject of five Federal investigations during the past 35 years and many studies by marketing agencies throughout the country. Most of these investigations resulted in the issuance of reports pointing out the seriousness of the situation and reaching the conclusion that something should be done to correct the conditions which are decreasing the returns to growers, increasing the prices paid by consumers, leading to deterioration of the products handled, and in many cases causing bankruptcy of members of the trade.

The Congress, in the Agricultural Marketing Act of 1946, directed the Department of Agriculture "to determine the needs and develop or assist in the development of plans for efficient facilities and methods of operating such facilities for the proper assembly, processing, transportation, storage, distribution, and handling of agricultural products." In compliance with this directive the Branch has been engaged in a wide variety of activities in planning and promoting the construction of satisfactory marketing facilities for all kinds of farm and food products in many places throughout the country.

No work on market facility planning is done in any locality except on the basis of a specific request from responsible individuals or agencies, assurance of the necessary cooperation of the interested groups, a real basis for thinking that improved marketing facilities are needed, and some likelihood that the facilities planned will be provided. Before a complete study of a local situation is undertaken, a representative of the Branch visits the locality from which the request for assistance came to make certain that these conditions exist. Then, if the effort seems justified, a thorough study of the problem is made. The volume of products being handled, or likely to be handled, is ascertained; present methods of handling, together with handling costs, are determined; the nature, amount, and methods of operation of existing facilities are studied; and, on the basis of this analysis of the current situation, a determination is made of the kind of facilities that would best meet the needs. If satisfactory facilities can be provided at reasonable cost by improving the facilities currently in use, such action is recommended. If not, a complete new layout and design for new facilities in a new location are drawn up. Possible satisfactory sites are analyzed, and the most suitable ones determined. The approximate cost of providing the facilities and the probable savings in distribution that would result from operating in them are calculated. At this stage, meetings are called of all interested groups, and the findings are presented with a scale model of the facilities proposed. Opportunity is provided for full discussion and comments or suggestions. After taking into consideration all ideas that may be advanced at such meetings, a report is published setting forth the findings of the study and the recommendations for action that should be taken.

The initiative in bringing about the construction of the needed facilities must be taken by local groups, but the Branch is usually called upon to give advice to these groups on such questions as the relative merits of the different types of organization that might own or operate the facilities, methods of financing, and other factors concerning the construction and operation of the facility. When the organization has been formed and a specific site acquired, it is usually necessary to redraw the layout of the proposed facility to fit the particular plot of ground that has been acquired. After local architects and engineers have been employed, there is frequent consultation between them and representatives of the Branch regarding the details of the design and layout. Often the persons employed to build the facilities do not thoroughly understand the reasons for certain recommendations made in the report. Upon completion of the market facility, the Branch is usually requested to advise on such subjects as market regulations needed, kind of equipment that should be used within the facilities, and the most efficient methods of operating. Since the new facilities and equipment are usually quite different from those which have been displaced, it becomes necessary to advise and demonstrate the most

efficient means of operating under the new conditions if the full benefits of the development are to be realized.

It should be noted that all the work of the Branch in connection with these facilities is of an advisory nature. Although local groups, in building facilities, to a great extent, follow the recommendations of the Branch, they are free to depart from them whenever they desire. Since the Government provides no financial assistance for the construction of the facilities, Federal assistance is limited to helping local groups solve their own problem.

During the past year the Branch assisted in developing plans or promoting the construction of market facilities in 25 localities, and gave less extensive assistance to many others. Among the types of marketing facilities planned were: Assembly markets in producing areas for fruits, vegetables, poultry, and eggs; country elevators; livestock auctions; wholesale markets for fruits, vegetables, poultry, eggs, meats, butter, cheese, and frozen foods; a meat packing plant; and warehouses of various types. Insofar as possible this work was carried on in cooperation with some appropriate State agency, such as the State Department of Agriculture, the Agricultural Experiment Station, or the Extension Service. In 14 places where market facilities have been planned, all or a part of the facilities have been constructed. In 4 places construction is under way. In some of the remaining 23 places for which facilities have been planned, definite action is being taken looking toward the provision of the facilities recommended, such as the formation of an organization to build, the purchase of land, or preliminary arrangements for financing. The status of the work at the end of the year in each of the localities in which the Branch was active during the year is described briefly in the following paragraphs.

ASSISTANCE ON MARKETS UNDER CONSTRUCTION

1. San Antonio, Tex.: The 2½-million-dollar market which the Branch assisted in planning in San Antonio was completed in September 1951, and the facilities were fully occupied at the beginning of its operations (fig. 1). This market contains a total of 85 store units for produce wholesalers, 150 stalls under sheds for farmers and truckers, 25 covered stalls for buyers, an office building, service station, and the necessary railroad tracks, paved streets, and parking areas. It was financed by a private builder and contractor, who leased the facility to a nonprofit corporation, the stockholders of which are the wholesale produce dealers, farmers, and truckers who operate on the market. The Branch participated in the opening of this market and has checked on the operating results to date. These results have been most satisfactory, exceeding all expectations. Operators in the market have reported both increases in the volume of business handled and reductions in operating costs. People from many parts of the country have visited the market to inspect its facilities and observe their operations.

2. Columbia, S. C.: The new million-dollar market in Columbia which the Branch assisted in planning was opened for business in November 1951 (fig. 2). This market contains a total of 61 wholesale store units for produce dealers, 125 covered stalls for farmers and truckers, a large number of open stalls for use during the peak season, an office building, service station, container storage shed,

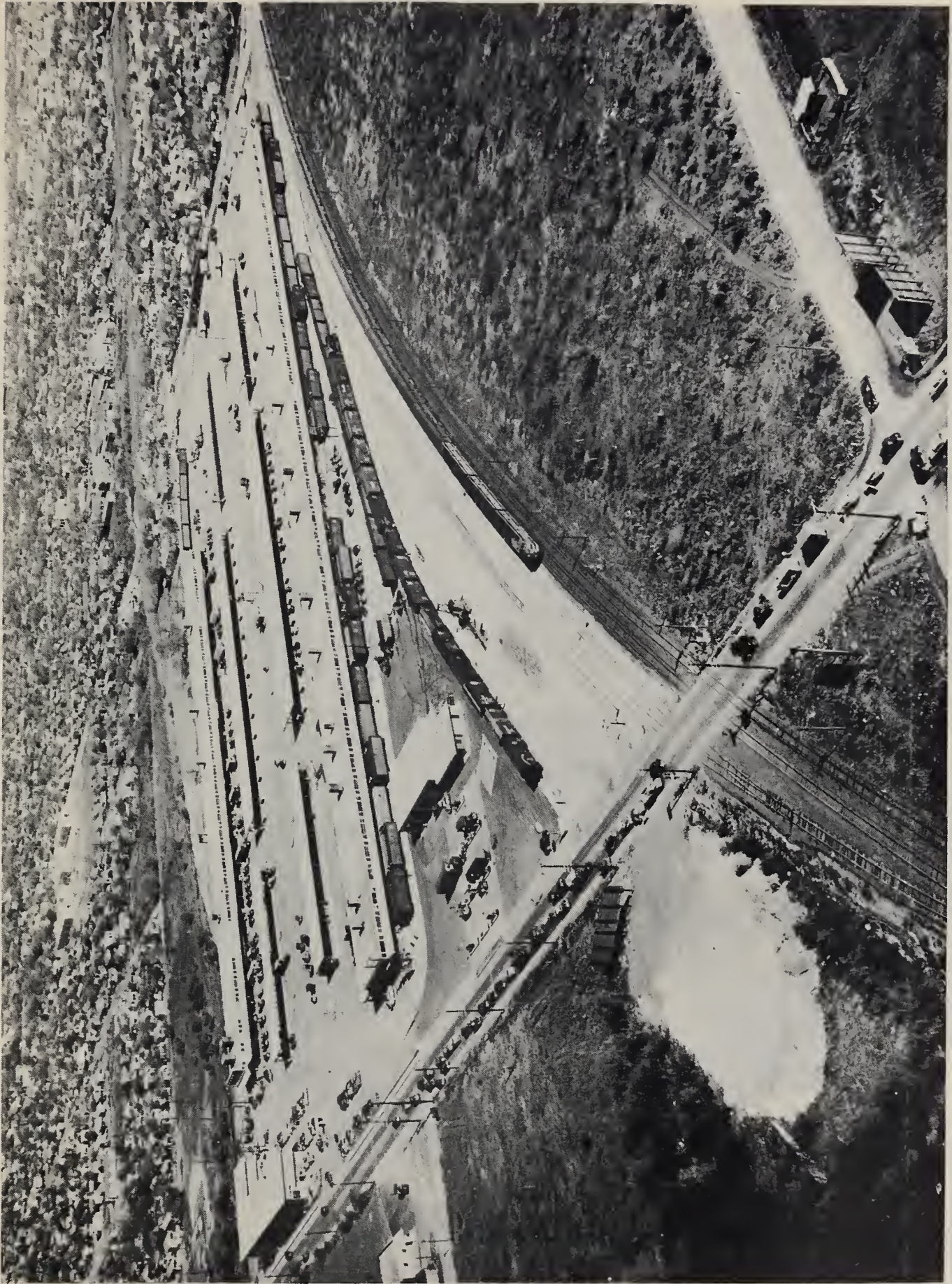


Figure 1.--The San Antonio, Tex., wholesale produce market.



Figure 2.---The Columbia, S. C., wholesale produce market.

and the necessary railroad tracks, paved streets, and parking areas. Sufficient land was included in the market site to permit 100-percent expansion in these facilities. The Branch not only participated in the opening of the market, but also assisted dealers in determining the kind of handling equipment that they should purchase and in showing them the best ways to use such equipment. At the annual meeting of the National Association of Produce Market Managers held in Columbia, a representative of the Branch conducted these market managers from all over the Nation through this market, explaining why the facilities were designed as they were, showing the kinds of handling equipment suited for such an operation, and pointing out that such handling equipment can be used only if the facility is properly designed. The market was built and is being operated by the South Carolina State Marketing Commission. Revenue collected during the first 7 months of operation has considerably exceeded the amount required to service the debt and pay all operating expenses. Dealers, farmers, and city and State officials are highly pleased with the facilities and with the success of the market during these first months of operation. The operating results have more than measured up to expectations. Many groups from various parts of the United States and from some foreign countries have visited the market since it opened to see its facilities and learn how it is operated.

3. Hartford, Conn.: The new wholesale produce market in Hartford which the Branch assisted in planning was under construction throughout the year, and from time to time the Branch has rendered assistance in connection with this construction. The market is expected to begin operation about the end of August 1952. It is being constructed by a Market Authority (public benefit corporation) established by the State of Connecticut. Thirty-two wholesale dealers in fruits, vegetables, frozen foods, and meats will occupy a total of 53 store units being constructed in three buildings. Twenty-seven of the units have a double railroad track in the rear. For the present, open stalls have been provided for the use of farmers and truckers, and room for future expansion of all of these facilities is available.

4. St. Louis, Mo.: The new wholesale produce market in St. Louis, which was recommended by the Branch as a result of a study of conditions there, has been under construction throughout the year, and upon request the Branch has assisted from time to time on problems that have arisen during its construction. This market will contain more than 100 wholesale store units, arranged in two parallel buildings with a wide street between and railroad tracks in the rear. Wholesalers are expected to begin operations on the market in the fall of 1952.

5. Indianapolis, Ind.: In June 1952 the contracts were signed for the construction of the new wholesale produce market in Indianapolis, with a completion date for the initial construction set for November 15, 1952. The facilities planned include those necessary for the wholesale handling of fruits, vegetables, poultry, and eggs, and arrangements are being worked out to provide for some wholesale handlers of dry groceries and allied industries in the wholesale food field. Ample land has been acquired for this market, and the initial construction has been so laid out that orderly expansion to meet future requirements will be possible. This market is being built by a corporation, the stockholders of which are the tenants of the market. Throughout the year representatives of the Branch have worked closely with this corporation in developing the detailed plans and method of operation.

6. Boston, Mass.: Negotiations for the site recommended as a result of a study by this Branch for a new wholesale produce market to handle fruits, vegetables, poultry, eggs, and meat have almost been completed. It contains nearly 200 acres, and is large enough to permit consolidation in this area of wholesaling operations that are now being carried on in several parts of the city. The first stores in the meat section of the market are under construction, and lease agreements are being signed with wholesalers of fruits, vegetables, poultry, and eggs. The engineers employed to develop the plans and specifications of the entire market area have completed their report. The bonding house that is handling the financing has completed its investigation and given approval to the project. The extent of financing will depend upon the amount of facilities required to meet the needs of those tenants who will sign leases.

7. Winston-Salem, N. C.: The recommendations of the Branch that were made as a result of its study of the wholesale market facilities for fruits and vegetables in Winston-Salem have been carried out, and the temporary solution recommended appears to be working out satisfactorily. In Winston-Salem, instead of suggesting that a new market be constructed, the Branch proposed the acquisition of additional space adjacent to the existing facilities.

WORK DONE IN DEVELOPING OTHER MARKETS PREVIOUSLY RECOMMENDED

1. San Juan, P. R.: In June 1951 the Branch issued its report recommending the construction of new wholesale market facilities in San Juan, including docks, warehouses, wholesale stores, stockyards, meat-packing plant, grain elevator, feed-mixing mill, sheds for farmers and truckers, and a retail market. The proposed site and layout for the market have been approved by the Government of Puerto Rico, which has appropriated 4¼ million dollars to defray the cost of the initial phases of its construction, including the dredging of the channel, the building of bulkheads and piers, and other aspects of site development. During the year it was necessary for a representative of the Branch to make two trips to Puerto Rico to continue working with the local authorities in developing and carrying out the proposed plan. Puerto Rican officials report that they have found a satisfactory operator for the meat-packing plant, who has offered to put \$800,000 into the cost of its construction and who will build and operate the facilities in accordance with the recommendations of the Branch. Work on dredging the channel and building the necessary bulkheads and docks in the market area is expected to start in the immediate future.

2. Richmond, Va.: During the year the engineers employed by the Market Authority established by the State of Virginia to build a market in Richmond have completed the drawing up of plans and specifications for the new wholesale produce market expected to be constructed there. On several occasions personnel of the Branch who made the study of market conditions in Richmond have been called in by the Authority and the engineers to assist in various aspects of the development of the project. The Authority is now in the process of trying to arrange for the financing of the market.

3. Houston, Tex.: A corporation has been formed to build the facilities recommended by the Branch, the site has been selected, and personnel have been employed

to handle the promotional aspects of obtaining lease agreements from the tenants and constructing facilities. Twice during the year the Branch has been called upon to provide assistance to the trade group that is to construct the market, and, as the year closed, representatives of the Branch were in Houston helping develop the final layout prior to the beginning of construction work. Preliminary drafts of the contracts covering the construction have been drawn up and orally approved. The market is being built by a private corporation, the stockholders of which consist primarily of persons that will be tenants of the facilities.

4. Milwaukee, Wis.: Several times during the year the Branch was called upon to furnish supplementary information to groups in Milwaukee that are planning the construction of new market facilities for the wholesale handling of perishables, recommended by the Branch in cooperation with the University of Wisconsin at the conclusion of a study in a previous year. As the year closed, representations were being made to the proper State officials to charter a public benefit corporation to build and operate the market. Since the recommendations were made several years ago and conditions may have changed, city officials in Milwaukee have requested that they be brought up to date as soon as the corporation has been created to build the market.

5. Norfolk, Va.: The year brought renewed interest in the building of a new wholesale produce market in Norfolk which was recommended in a report issued in June 1950. Upon request of people in Norfolk representatives of the Branch, in cooperation with the State Department of Agriculture and the Virginia Polytechnic Institute, have made a study of the sites that are currently available and recommended the most satisfactory site for the market. Interested people in Norfolk plan to create a private corporation to construct the facilities.

6. Huntington, W. Va.: Several times during the year representatives of the Branch have been called upon to supply additional information to various groups in Huntington that are continuing their efforts to provide satisfactory wholesale market facilities for that city. The Chamber of Commerce, city officials, and members of the trade have been very active in the promotion of this project. Agreement has been reached on a site, and efforts are now being made to complete the arrangements for financing.

STUDIES CONDUCTED DURING THE YEAR TO DEVELOP MARKET FACILITIES

1. Philadelphia, Pa.: The Greater Philadelphia Movement, a civic organization in Philadelphia, has become interested in building a new wholesale produce market to handle fruits, vegetables, poultry, eggs, and fish in the vicinity of the railroad produce terminals. Upon request of that agency, the Branch, in cooperation with the Pennsylvania State College, made a study of the current situation in Philadelphia and developed a layout for the necessary facilities on each of three sites in the vicinity of the produce terminals. In October 1951 a report was published showing the facilities needed, their estimated cost, and what rentals would have to be charged for them compared with those currently being paid. The proposed facilities were estimated to cost about \$4,000,000. This figure is lower than would be expected for a market in a city the size of Philadelphia because by continuing to use the

railroad-owned produce market facilities in the area, the additional construction required to provide a complete market could be held to a minimum. The report shows that it would be possible to provide modern stores and rent them to the wholesale trade for approximately 60 percent of the rentals these dealers are now paying for the inadequate facilities they are using in the Dock Street Market area. Frequently during the year representatives of the Branch have been called on for additional assistance looking toward the construction of these facilities.

2. Beckley, W. Va.: The report setting forth the findings and recommendations of a study of the facility needs in Beckley, which was started in the spring of 1951, was published in February 1952. This study was made in cooperation with West Virginia University. During the survey of conditions in the Beckley area wholesale distributors showed little interest in the development of a new market, and it was determined that farmers, because of their limited production, have no need for such a market. The greater part of the food supply consumed in the city comes from larger marketing centers outside the area. Thus the establishment of a wholesale market place within or near Beckley would serve no useful purpose, but would only require another unloading, loading, and handling charge, thereby increasing distribution costs. Because of these conditions it was recommended that no attempt be made to establish a central market in this area.

3. Waco, Tex.: At the request of the Waco Chamber of Commerce a brief survey was made in cooperation with the Texas Agricultural Experiment Station of the wholesale produce market situation in that area. The only dissatisfaction found with present facilities was that of a few farmers and truckers who objected to certain features of the Municipal Market. Most of the handlers of perishable foods were operating in facilities that were reasonably efficient. Therefore it was impossible to show that such operators could improve the efficiency of marketing by providing new or additional facilities. Under such conditions the only recommendations were for some minor changes in the Municipal Market, to be made only if it were possible to increase the revenue from these facilities by an amount sufficient to warrant the expenditure.

4. Toledo, Ohio: At the request of city officials a study was undertaken in the fall of 1951 in cooperation with the University of Toledo to determine what improvements should be made in the marketing facilities for the handling of perishable commodities. A report on the findings was published in June 1952. Due to a lack of sufficient interest in the building of new facilities no new market was recommended. However, in order to assist all interested groups in Toledo in developing a long-term plan for market improvement, a layout for a good wholesale market was developed, consisting of 40 store units for wholesalers, 70 covered stalls for farmers and truckers, adequate rail trackage, parking areas, streets, a restaurant, and a market office. The total cost of such a market was estimated at not more than \$1,000,000. The relative merits of building such a facility by the city or by a private nonprofit or limited profit corporation were discussed. Since it will take several years for all interested groups to decide upon the advisability of building a new market, the report suggested some inexpensive improvements in the present city-owned facilities if such improvements could be financed from rentals.

5. Rochester, N. Y.: Upon request of the Genesee Valley Regional Market Authority a study of the marketing facility needs of the Rochester area was made in cooperation with the New York Department of Agriculture and Markets. Before the close of the year a preliminary report on the study was presented to the Market Authority, outlining the conditions found and suggesting two approaches to the solution of the problem. One method of dealing with the situation would be the relocation and rebuilding of the present wholesale market district in Rochester. Such a development would require the construction of 19 wholesale store units, 200 covered stalls for farmers and truckers, restaurant, market office, railroad tracks, streets, and parking areas, at an estimated cost of about \$700,000. Since the study revealed that most wholesalers in Rochester had little interest in a new consolidated market, the report pointed out that it might be difficult to obtain their cooperation in providing a successful market. In the event that sufficient interest from the trade could not be developed to justify a consolidated market in Rochester, it was suggested that consideration be given to establishing a shipping point market some distance south of Rochester, at which growers in the area might bring their products for movement to points out of the area. A layout was developed for such a market and the cost estimated to be about \$135,000. In making the report to the Authority it was suggested that neither type of market be constructed until assurance is received from a sufficient number of tenants that they will operate in the facilities if they are built.

6. Detroit, Mich.: At the request of the Detroit Bureau of Markets, Weights and Measures the facilities and operations of the Municipal Farmers Wholesale Markets were examined to ascertain what improvements, if any, were needed in them. As the year closed, a report was being written which will contain recommendations for improvements in these facilities in order that they may more efficiently perform the services for which they were established. The report recognizes that it is not possible to develop a highly efficient wholesale produce market in Detroit by dealing only with the farmers' wholesale markets. In developing suggestions for improving only the farmers' markets care was exercised not to recommend action which would interfere with any future plans which may develop to improve the over-all market facilities in Detroit.

7. Tuscaloosa, Ala.: Upon request of State, county, and city agencies a study was made in cooperation with the State Extension Service of the operation of the Farmers' Curb Market in Tuscaloosa. Consideration was given to the need for a central wholesale produce market in the city. In the report on this investigation it was pointed out that the existing system of handling produce at wholesale was reasonably efficient, and that there was no great need for the establishment of a central wholesale produce market. However, recommendations were made for a new curb market. The report suggested the kind and amount of facilities needed for such a market and recommended a desirable site.

8. Bridgeport, Conn.: In June 1952 a study of the market facility needs in Bridgeport was undertaken at the request of, and in cooperation with, the Connecticut Market Authority and local produce trade groups. As the year ended, the existing facilities were being studied as a basis for determining the need for improvements in order to bring about more efficient marketing of food in the Bridgeport area.

9. Arizona: In May 1952 Part 2 of a study on the relation between locker plants and home freezers in the distribution of frozen foods in Arizona was published. This part of the study deals with quantity buying for home-freezer storage. The study was made in cooperation with the University of Arizona, Arizona State College at Tempe, and the Arizona Frozen Food Locker Association. General information concerning locker plants and their relationship to home freezers was gathered throughout the State, while more detailed studies were made in the Phoenix and Tucson areas. One phase of Part 2 deals with an evaluation of the economy and convenience of using home freezers in Arizona. The other describes and appraises the manner in which home freezer-owners obtain food supplies for their freezers.

10. Egg facilities in western North Carolina: At the request of the Winston-Salem Chamber of Commerce the Branch cooperated with the North Carolina Department of Agriculture and the Agricultural Extension Service of the North Carolina State College in a study of egg-marketing facilities in an 18-county area in western North Carolina. The types and capacity of existing facilities in the area were evaluated. Improvements needed in these facilities were determined, and findings and recommendations were presented to interested groups at two meetings. As the year ended, a report was being written for publication.

11. Grain-marketing facilities in western North Carolina: In response to a request from the Chamber of Commerce in Winston-Salem and other agencies in the State of North Carolina a study was made of the marketing facilities being used for handling grain in the Piedmont area of the State. The purpose of the study was to appraise the existing facilities and make recommendations for their improvement. Field work on the study was carried on in the winter of 1951-52 in cooperation with the State Extension Service and the State Department of Agriculture. A preliminary report of the findings and recommendations was made at a meeting held in Winston-Salem in April. Specific recommendations were made with respect to new facilities needed at specific locations and to some changes needed in the present system of handling, including the following: (1) Develop facilities for handling all grain in bulk; (2) establish a system of buying and selling all grain by grade; (3) have facilities at receiving points to handle and move grain by mechanical means, thereby decreasing high labor costs; (4) provide adequate storage where grain can be kept in proper condition; (5) provide facilities for drying grain and eliminating insect infestation before and during storage; and (6) improve grain transportation facilities. As a start toward providing adequate storage facilities it was tentatively recommended that the supplies of grain assembled for marketing in each of three specific locations warranted the construction at each location of one elevator of at least 250,000-bushel storage capacity, and that such elevators be operated in connection with grain-processing plants. It was further recommended that these elevators be so designed as to permit future expansion. Preliminary estimates indicated that the provision of adequate marketing facilities for the handling of grain in this area should result in benefits of more than \$2,000,000 per year. A complete report on this study is in the process of preparation,

12. Livestock marketing facilities in northwestern North Carolina: The Branch cooperated with the North Carolina Agricultural Extension Service and the North Carolina Department of Agriculture in a study to determine whether present livestock marketing facilities and practices in 18 counties in northwestern North Carolina are

satisfactory, and whether or not additional marketing facilities are needed at this time in order to take care of some increases in production. This study was made at the request of the Chambers of Commerce of Greensboro and Winston-Salem. A report on the findings was issued in May 1952 by the North Carolina Agricultural Extension Service. It was concluded that the existing facilities can handle present livestock numbers and any expansion likely to take place in the near future. However, some worth while improvements that might be made in the facilities and practices in the area are: (1) Provide safe and convenient loading and unloading facilities, (2) arrange pens and walks to permit convenient and rapid handling of animals, (3) provide a large well-lighted sales ring and comfortable seating for buyers and sellers, (4) provide adequate parking space, (5) make the market attractive and sanitary, (6) sell livestock only, (7) sell on a grade basis, (8) weigh at time of sale on scales with a large dial visible in sales ring, (9) provide for better functioning of price-making forces on the markets, and (10) adopt an aggressive promotional campaign to encourage livestock production and marketing in the area. This last recommendation was based largely on production studies made by agencies in North Carolina which concluded that livestock production should be expanded in the area.

MISCELLANEOUS ACTIVITIES

In addition to the studies conducted and efforts made to promote the construction of complete marketing facilities in particular localities described above, the Branch was called on frequently throughout the year for advice from individuals desiring to build single warehouses, stores, or processing plants. Although detailed studies could not be made for these individuals, the Branch did help them in the following ways: (1) Answering specific queries by mail, (2) sending them such published material as was applicable to the situation, and (3) discussing with them their problems and plans when they came to Washington or to some other city where Branch personnel was working. No record has been kept of all the assistance given, but the following examples illustrate the nature of this work.

The Agricultural Extension Service of South Carolina requested the Branch to help determine the requirements and develop plans for turkey-processing and -marketing facilities in that State. At the request of producers a meeting was held in March 1952 to discuss the specific requirements for the establishment of a processing plant and to determine the best location for it. This meeting was attended by producers, civic officials, feed dealers, hatcherymen, county agents and other representatives of the Extension Service, and representatives of the South Carolina State Marketing Commission. Several plant layouts were developed, and equipment requirements were determined. Processing and refrigeration equipment manufacturers were consulted, and with their assistance cost estimates were made. The Inspection and Grading Division of the Poultry Branch was consulted for approval of plant layouts so that turkeys might be processed under supervision of Government inspectors. At the request of the turkey producers the Reconstruction Finance Corporation furnished information relative to the procedure for submittal of loan applications and the conditions under which loans for facilities could be obtained. All of this material was assembled and presented in May at another meeting of the interested producers, businessmen, and local and State officials.

At the request of the Department of Agriculture and Immigration of Virginia this Branch, in cooperation with the Poultry Branch and the Agricultural Extension Service of Virginia, developed a revised plant layout for one of the State's largest egg assembly plants. It is expected that appropriate action soon will be taken to adopt the new layout in order to eliminate existing bottlenecks and improve operating efficiency.

The marketing facilities developed in Greenville in a previous year, following a study of the situation by the Branch, have continued to operate satisfactorily, and it was necessary to double the amount of facilities originally provided. From time to time informal assistance has been given in designing additional facilities to handle types of businesses not provided for in the original construction.

The Branch has continued to give assistance to the people in Nashville who are arranging for the construction of the market recommended there. During the year the site recommended has been purchased and financing arrangements completed. Although it was not necessary to do much work in Nashville this year, more will be required when construction is ready to go forward.

At the request of State agencies in New Mexico a representative of the Branch met with appropriate groups in Albuquerque in April 1952 to examine their market facilities in order to determine whether or not the situation warranted the construction of different facilities. The conclusions reached at these meetings were that new facilities are not needed at this time, but that when plans for adjustments in production in the area are carried out, additional facilities might be needed. Similar assistance was given in Texarkana, Ark., and Atlanta, Tex., where conclusions were the same.

Several persons planning to build various kinds of marketing facilities, including service wholesale warehouses, refrigerated warehouses, and apple storage houses, visited the offices of the Branch during the year to obtain suggestions as to the proper design for such facilities and the types of equipment that should be used in operating them. Fortunately, on the basis of studies of facilities and equipment that have been made, it was possible to give considerable assistance to these people. Several financial institutions have requested advice on the soundness of market facility proposals which were being considered by them. In addition to persons from various parts of the United States, representatives of many foreign countries visited the Branch during the year and requested advice on planning market facilities in their countries. In at least two of these cases, when these representatives returned to their countries, they developed plans for constructing facilities and sent them to the Branch for criticism.

As the number of completed studies on market facility needs increases, the amount of work required in advising regarding the construction of the facilities and their operation increases, which of course limits the number of new studies that can be made during a year. At the end of the year the Branch had requests from 24 localities for market facility studies which it had not yet been able to begin.

Since all the facilities built according to the recommendations of the Branch have worked out satisfactorily, the work of the Branch is becoming widely recognized, as evidenced by the increased demand for its services. Another illustration of the recognition being received was the presentation by the Washington Chapter of the American Marketing Association of its 1951 award for outstanding contribution of a Government agency to the field of marketing to the employees of this Branch for their study and report on the wholesale produce markets at Boston.

STUDIES TO DETERMINE HOW TO PLAN SUCCESSFUL MARKETING FACILITIES

The general objectives of this work are to determine principles and develop standards and criteria with respect to proper layout, design, size, location, methods of financing, methods of operating, and other factors affecting the success of various types of marketing facilities for farm and food products. Work in this field is designed to provide data and criteria needed by the Branch in planning and promoting the construction of improved marketing facilities in specific localities, and by enterprisers who plan and construct their own individual facilities. During the year the following studies were conducted.

CRITERIA FOR ESTABLISHING SHIPPING POINT FRUIT AND VEGETABLE MARKETS

This study was undertaken in cooperation with the Cooperative Research and Service Division, Farm Credit Administration, for the purpose of determining the factors that affect the success of and to develop criteria or guides for the establishment of new shipping point fruit and vegetable markets. As interest in markets of this type has grown over the years, many facilities built in producing areas have failed; others have succeeded. To minimize losses in capital expenditures and insure against comparatively lower returns to growers that result from having too many markets with too small a volume, data from this study point out the conditions that are necessary to make reasonably certain that a shipping point market, if built, will succeed. Conversely, these data provide criteria which should aid in preventing the waste of funds by various groups in building facilities in producing areas that are doomed to failure before they are constructed.

During the year work on the study was completed, and a report, entitled *Farmers' Produce Markets in the United States--Part III--Shipping Point Fruit and Vegetable Markets*, was published. Among the criteria suggested in the report for establishing new markets of this type are:

1. The minimum daily volume of business required (a) for average-value produce is roughly 3.6 equivalent carloads or about 1,800 packages, and (b) for high unit value produce about 1.8 equivalent carloads or 900 packages.
2. Management should concentrate in the beginning on obtaining a relatively large percentage of the production for market, in the immediate area, of one or two major fruit and vegetable items, and add an additional item each year until the market reaches its effective peak.
3. The market must obtain from 75 to 90 percent of its receipts from an area within a 25-mile radius of the location of the market.
4. Unless it can definitely be determined in advance that a new market will attract a larger percentage of the total production for market than the average percentage attracted to existing markets, the total production of fruits and vegetables available for daily sale in the local area should be about 5 times larger than the minimum daily volumes required on the market.

5. On the basis of the average size of grower loads received on shipping point markets, about 60 grower loads would be needed daily to supply the minimum volume required.

6. The management of a new market should attempt to obtain a minimum of three season buyers and as many day buyers as possible. After the market becomes established, an average daily volume of 1,800 packages should attract seven or eight buyers.

FACTORS THAT AFFECT THE SUCCESS OF COUNTRY ELEVATORS

The objectives of a study of 18 country elevators were to find out what facilities and equipment are needed in a country elevator to market grains efficiently, as well as to develop criteria which could be used in determining whether or not a country elevator should be built in a particular area, and what location, capacity, layout, construction, and methods of operation would be most desirable.

Although the country elevators were constructed primarily to facilitate the market movement and storage of grain, the study revealed that for the period 1947-49 only 23 percent of their income was derived from this source. Selling side-line merchandise was the main source of income, accounting for 66 percent of the total income, while custom services brought in 11 percent.

Many elevators with small grain storage capacities marketed much more grain than elevators with large storage capacities. Most elevators could have handled and marketed much more grain if it had been available. The income from grain marketing alone usually would not have been sufficient to pay the minimum costs of elevator operation at prevailing marketing margins.

The greatest single factor contributing to the successful operation of country elevators was centered around alert and intelligent management. Able management in individual elevators overcame mediocre facilities, but excellent facilities were not a guarantee of financial success.

From this study criteria were developed for use in arriving at decisions as to the need for a proposed country elevator in a specific area. For a particular area, it is necessary to determine (1) the volume of grain moving into commercial channels, (2) the volume of feed mixing and grinding and other custom services done in the area, and (3) the possible revenue from such operations. The combined potential revenue from such sources must equal the total costs of operation and maintenance of the proposed elevator. Any possible income from potential side-line merchandising should be ignored in determining the feasibility of building a facility designed and equipped to handle grain only.

The site of a proposed new elevator should (1) Be adjacent to a railroad supplying timely and reliable switching services; (2) be accessible from any direction by good all-weather highways and roads; (3) have adequate power available;

(4) be properly drained; (5) be convenient to local customers; (6) have sufficient area for possible future expansion and to care for elevator traffic; (7) be far enough removed from the center of population so that elevator dust, smoke, and noise will not be a public nuisance; and (8) be situated so that elevator traffic will not contribute to local traffic problems.

Structures and facilities on an elevator site, equipment within the structures, and all other facilities and equipment related to elevator operation should be placed so that: (1) labor can be most efficiently utilized; (2) grain can be handled with the least amount of power and equipment; (3) customers can be served with the greatest convenience; and (4) space is available for the free and efficient movement of all traffic connected with all probable types of elevator enterprises.

The amount of grain storage space to be built into a contemplated elevator should be gauged by the amount of space needed for operative storage under local conditions plus the amount of storage space which can be profitably rented. The volume of grain which an elevator can handle in a day is not regulated by its grain storage capacity but by the movement capacity of its equipment, provided that adequate railroad cars and motortrucks are available to move the grain away from the elevator. A grain storage capacity of 10,000 bushels and an hourly capacity of 750 to 1,000 bushels will handle peak loads of grain marketed at harvest time in most areas where extremely high peak loads do not occur. In areas where very large volumes of grain may be received during a short harvest period, a substantially greater volume of operational space may be needed, as well as handling equipment of greater capacity. If several types and grades of grain are to be received simultaneously, the number of grain storage bins needed will be greater than if only one type of grain is harvested at one time.

CRITERIA FOR PLANNING A WHOLESALE FROZEN FOOD DISTRIBUTION PLANT

Although the expansion of the frozen food industry in recent years has brought about decreasing costs in packing and freezing operations because of fuller utilization of equipment and labor, frozen food distribution costs have continued to climb. The two principal reasons for continued increases in costs are: (1) The use by wholesale distributors of facilities that, in most cases, are entirely inadequate for handling current volumes, and (2) the use of purely manual labor for performing a number of jobs or operations which could be performed more efficiently by use of machines, provided adequate and properly designed facilities were available. Because of the industry's limited experience and the lack of research, wholesale frozen food distributors have not had available adequate "know-how" or data on the planning of efficient facility layouts and designs or the operation of the wholesale frozen food plants. This situation has discouraged the construction of needed facilities. To meet industry needs, studies of frozen food wholesaling operations were begun in 1949. Work plans for such studies called first for a study and general publication, to be followed by more specific studies and reports pinpointing and answering more fully some of the problems treated in the general report. The objective of the first report was to provide wholesale frozen food distributors and research workers with a

composite picture of the advantages and disadvantages of different methods of operations and provide guide lines for future research. The majority of the data for developing criteria with respect to planning a wholesale frozen food distribution plant was gathered prior to April 1951. The analysis of these data, the preparation of a report, and the development of necessary supplemental data were completed in March 1952 and the report published in June 1952. This project was conducted in cooperation with the National Wholesale Frozen Food Distributors' Association and covered all sections of the United States.

This report, entitled *Planning a Wholesale Frozen Food Distribution Plant*, contains information which should be of assistance to distributors in planning new facilities or remodeling or expanding old structures and in organizing order-assembly operations for greater efficiency. Factors that should be considered by wholesalers in choosing between public and private warehouses for the location of operations, designing efficient order-assembly layouts, selecting and using suitable materials-handling equipment, and selecting desirable wholesale plant locations are discussed in the report. Recommended layouts for the various components of wholesale distribution plants, types of equipment that might be used, and arrangement of merchandise in storage are included. At the close of the year plans were being developed for additional studies that should provide more specific answers to problems or methods not covered in the report.

IMPROVED LAYOUTS, DESIGNS, AND METHODS OF OPERATING LIVESTOCK AUCTION MARKETS

In recent years auction markets have become increasingly important in the marketing of Texas livestock. The rapid growth of this type of facility in many cases has resulted in inefficient facilities, equipment, and methods of operation.

In 1951 a study of livestock auction markets in Texas was undertaken by the Branch in cooperation with the Texas Agricultural Experiment Station to determine the practices, methods of operation, and design of facilities which would increase the efficiency of auction markets and to establish the economic factors which determine the success or failure of auction markets. In the work to date emphasis has been placed on the achievement of the first objective. Field work was begun in March 1951. A sample of 10 auction markets was selected for intensive study. The choice of markets to be studied was based on total volume handled, species handled, sales days, and geographical location within the State. The operations within each market were studied in detail. Time studies were made to determine the labor requirements with different methods, in different types of facilities, for performing specific operations and cycles of operations. Flow diagrams and process charts were made to point out bottlenecks, duplication of work, and unnecessary operations. Market personnel, buyers, and consignors were interviewed for suggestions concerning the correction of defects of present markets. Outstanding operations and facilities in other markets were also studied.

These field studies have pointed up the major defects of present livestock auction markets in Texas, and provide criteria for designing a modern and efficient facility and for establishing the proper crew size and arrangement for the performance of various operations required in moving livestock through the market.

A joint report, now nearing completion, will describe and list defects of present market facilities and methods, offer suggestions for correcting those defects, and contain plans for a modern, efficient facility which will permit a smooth and steady flow of livestock through the various marketing operations. The plans for an improved facility provide for expansion to meet the needs of increasing volumes. The report will be completed and published during the next fiscal year. Upon completion of this phase of the study work will be concentrated on the second project objective.

PRINCIPLES FOR PLANNING EGG ASSEMBLY FACILITIES

In April 1951 a study of egg assembly plants was initiated to assemble data and information on handling methods, plant operations, and layouts of facilities on a nation-wide basis. The data will be used to determine principles and develop standards and criteria for plant design and operations for use in the development of facility plans for specific markets and for individual firms. This study will also provide a more accurate basis for selecting plants for case studies of materials-handling and other operations.

Plant studies have been made in New Jersey, Minnesota, Wisconsin, and Texas. In all States the extension poultry and egg marketing specialist and representatives of the State Departments of Agriculture have assisted in the selection of and made preliminary visits with Branch personnel to egg assembly plants selected to arrange for cooperation. Their assistance has been particularly valuable in selecting plants of varying sizes which were representative of the area being studied.

Information on plant layout, flow diagrams, equipment inventory and arrangement, sequence of operations, and plant productivity has been obtained on 21 egg assembly plants. In some instances, photographs of specialized equipment, innovations in handling methods, or plant designs were taken to provide a visual means of illustrating and recommending improved handling methods. In 8 of the plants studied it has been possible to make specific recommendations to the plant manager for the improvement of handling methods. In 3 instances requests were made for recommendations on the handling of eggs in proposed plant additions.

During the next fiscal year it is contemplated that additional plant studies will be made in the more important egg-producing areas of Iowa and California and that two reports will be published. These reports will cover: (1) Egg-handling methods and equipment in assembly plants in producing areas, and (2) egg-marketing facilities for producing areas.

PLANNING FLUE-CURED TOBACCO MARKET FACILITIES

The purpose of this study was to develop principles that should be followed in planning the kinds of facilities and equipment needed to provide for the most efficient handling of tobacco. The achievement of this objective involved a determination of the amount of floor space needed on market facilities to handle most efficiently given volumes of tobacco. Field work was done in cooperation with an advisory committee of the Bright Belt Warehouse Association.

During the past year visits were made to selected markets in the flue-cured tobacco areas of Florida, Georgia, South Carolina, North Carolina, and Virginia for the purpose of studying tobacco-handling operations and to obtain information and data from warehousemen, trade officials, and marketing specialists of the Experiment Stations and State Departments of Agriculture. A preliminary draft of a report incorporating the analysis of the data from all markets as well as observations and ideas from the industry and government officials has been completed.

TYPES OF OWNERSHIP AND METHODS OF FINANCING WHOLESALE PRODUCE MARKETS

To meet the needs of State and local groups interested in selecting the proper type of ownership and investigating various methods of financing improved market facilities, work was undertaken in July 1950 on the preparation of a manual covering types of ownership and methods of financing wholesale produce markets. A preliminary draft of the manual has been prepared. The final draft will be completed and published during the next fiscal year. In this manual the public character of markets is discussed, and the essentials of desirable ownership which will protect the interest of the public and the users of such facilities are outlined. The report appraises five different types of ownership, points out possible sources of funds, and discusses the different types of collateral usually required of different types of borrowers.

IMPROVING HANDLING METHODS AND EQUIPMENT

It is estimated that in industry as a whole 32 percent of the total labor employed is used for handling materials--unloading materials (parts or raw materials) from railroad cars or motortrucks, moving the materials into storage or to assembly lines, moving the finished product to storage, and moving it out of storage and loading out. In a number of food-handling industries, such as the warehouses of wholesale fruit and vegetable distributors and public refrigerated warehouses, nearly all of the labor employed is used for the physical handling of materials. With the exception of fruit and vegetable wholesalers who ripen and pack tomatoes or ripen, cut, and pack bananas, these dealers receive and ship out products in the original packages and are almost wholly handlers of materials. They add nothing to the intrinsic value of the products handled. By rough and excessive handling and through inadequate protection they may even lower the intrinsic value of such products.

The objectives of this research are to increase the efficiency of materials-handling operations at various stages in the marketing channel, conserve manpower, and reduce spoilage and waste by: (1) Determining the comparative efficiency of various types or combinations of types of materials-handling equipment and methods and promoting the use of the most efficient types and methods, (2) developing improved methods and types of equipment for performing specific operations, (3) determining the proper amounts of equipment for enterprisers of various sizes, and (4) determining the comparative space utilization in facilities when different types or combinations of types of equipment are used.

Four materials-handling research projects were under way at the end of the year. These projects covered operations in: (1) The stores and warehouses of wholesale fruit and vegetable distributors, (2) commercial apple packing and storage houses, (3) public refrigerated warehouses, and (4) cotton warehouses. Work in fruit and vegetable warehouses and in cotton warehouses is being conducted by Branch personnel. Work in apple houses and in public refrigerated warehouses is being conducted under contracts.

STORES AND WAREHOUSES OF WHOLESALE FRUIT AND VEGETABLE DISTRIBUTORS

A case study approach is being used in developing data. Time studies have been made in stores and warehouses located throughout the United States to obtain data on labor and equipment inputs required with various methods and types of equipment. Emphasis is placed on obtaining comparative cost data with respect to specific materials-handling operations performed with different methods, including the different kinds of equipment, which will be useful to the industry as a whole. Contacts for performing time studies are made sometimes through fruit and vegetable trade associations. When trying out a new method, it is frequently necessary to call upon equipment manufacturers to supply the handling equipment needed.

Work has been inaugurated and part of the research completed on a study of equipment and facilities for receiving, ripening, and cutting bananas. When completed, this report should aid in bringing about greater efficiency in the handling of bananas by dealers of different sizes.

Warehouses of fresh fruit and vegetable service wholesalers were visited, and additional data gathered which served as the basis for an interim report covering the loading out of delivery trucks. This report describes and compares the costs of six methods currently used by service wholesalers. These methods and the costs per ton of produce handled with each method are as follows:

<i>Method A</i>	- Use of low-lift platform trucks and dead skids for assembling, and belt conveyors for loading	\$2.18
<i>Method B</i>	- Use of two-wheel hand trucks, semilive skids, and jacks for assembling, and belt conveyors for loading	1.58
<i>Method C</i>	- Use of semilive skids and jacks for assembling, and elevating and horizontal belt conveyors for loading . . .	2.20
<i>Method D</i>	- Use of fork-lift trucks and pallets for assembling, and belt conveyors for loading	1.50
<i>Method E</i>	- Use of four-wheel hand trucks, fork-lift trucks, and pallets for assembling, and gravity conveyors and manual handling for loading	2.27
<i>Method F</i>	- Use of four-wheel hand trucks for both assembling and loading	1.43

An assumed wage rate of \$1.50 per hour was used in computing labor costs. In addition to labor costs, the per-ton costs shown include equipment costs.

Assistance was given to a number of individual dealers in improving their materials-handling operations. In some cases data were developed and added to the data which have been accumulated to date and which will serve as the basis for the final project report.

In promoting the findings under this project a demonstration of a wide range of types of materials-handling equipment was arranged and conducted on the new Columbia State Farmers' Market. This demonstration was conducted in conjunction with the annual convention of the National Association of Produce Market Managers, and served as a medium for giving the market managers and others in attendance the results of some of the work done on this project.

COMMERCIAL APPLE PACKING AND STORAGE HOUSES

Work inaugurated in September 1950 by the Washington State Apple Commission under a research contract was continued during the fiscal year 1952 and expanded to include additional case studies of materials-handling operations in apple packing and storage houses. Case studies were conducted in 17 houses in the Yakima, Wenatchee, Okanogan, and Oroville districts of Washington. Data were obtained through the use of time study, methods analysis, ratio-delay studies, and other techniques. Standard time values for the handling of packages of apples and empty containers were

developed for seven cycles of operations which start at the loading of the motor-truck at the orchard and end after the fruit has moved through the storage and packing house and is loaded on motortrucks or railroad cars for movement to market. These values were developed for a total of 11 different types or combinations of types of materials-handling equipment. Data on the costs of ownership and operations of different types of materials-handling equipment were also developed, and together with labor costs can be used in computing the comparative costs for performing handling operations with different methods and types of equipment, under certain specified conditions, and in a given facility. In addition to the equipment currently in use in apple packing and storage houses 10 new types or combinations of types of materials-handling equipment were tested to determine their possibilities for increasing the efficiency of applicable handling operations.

One of the interim reports published during the year presented a comparison of the costs of receiving 1,000 field boxes of apples by use of each of five methods and types of equipment currently used in Pacific Northwest houses. These costs are: (1) Belt conveyors and clamp-type two-wheel hand trucks, \$9.58; (2) clamp-type two-wheel hand trucks alone, \$6.75; (3) floor chain conveyor and clamp-type two-wheel hand trucks, \$7.49; (4) industrial clamp-type trucks and clamp-type two-wheel hand trucks, \$5.17 where 24 boxes are transported per load and \$3.58 with 36 boxes per load; and (5) pallets and industrial fork-lift trucks, \$2.18 where 36 boxes make up a pallet load, and \$1.93 with 48 boxes per pallet. These costs are computed using assumed wage rates of \$1.25 per hour for common labor and \$1.50 per hour for semi-skilled labor (industrial truck operators). Per-hour equipment costs used in these computations include both the costs of ownership and operation. Ownership costs are based on typical annual hours of use per item of equipment in apple packing and storage houses. The combined costs per hour for the types of equipment used are: (1) Belt conveyor, \$0.71; (2) clamp-type two-wheel hand truck, \$0.05; (3) floor chain conveyor, \$0.95; (4) industrial clamp-type truck (2,000-pound capacity), \$1.80; (5) industrial fork-lift truck (2,000-pound capacity), \$1.53; and (6) industrial fork-lift truck (4,000-pound capacity), \$2.01.

During the course of this work a portable mechanical lift for high-piling and breaking out high-piled boxes of apples was developed and tested (fig. 3). Inquiries from industry people indicate that this item of equipment may have applicability to the handling of other food products which are high-piled in storage. The second interim report published during the year in connection with this project shows that, on the basis of test runs with the mechanical lift, estimated costs (labor and equipment) for high-piling 1,000 boxes of apples in 12-high stacks were \$3.17, compared with a cost of \$7.08 by the manual method. The costs for breaking out 1,000 boxes of fruit from 12-high stacks were \$1.51 by use of the mechanical method and \$6.04 when the manual method was used. These costs were computed by using assumed wage rates of \$1.25 per hour. Equipment costs, including both the cost of ownership and cost of operating the lift, used in these computations were 53 cents per hour for high-piling and 34 cents per hour for breaking out high-piled boxes.

A 16 mm. sound motion picture, in color, on *Apple Handling Methods* has been completed by the contractor and accepted by the Department. As soon as additional prints are made, this film, which runs 28 minutes, will be available through the



Figure 3.--Stacks raised with mechanical lift for positioning on top of two original 5-high stacks.

Motion Picture Service. The film covers current methods of handling apples in the Pacific Northwest area and appraises these by type of operation through comparisons of labor and equipment costs. It is estimated that during the 2 months this movie has been available it has been viewed by over 500 people in the apple industry.

Although this research is being conducted in the Pacific Northwest area, the results should be applicable in all apple producing areas, particularly in those areas using less advanced types of equipment, since these areas are just now adopting equipment which is being abandoned as obsolete in the State of Washington. All field work on this project has been completed and the final report, which is now being prepared, is due on or before September 30, 1952. The final report will serve as the basis for one or for several Department reports covering materials-handling operations in apple packing and storage houses.

PUBLIC REFRIGERATED WAREHOUSES

Materials-handling research in this type of facility was undertaken under a contract with a private engineering research organization. Case studies are now

under way in six public refrigerated warehouses selected to represent a cross section of the facilities and handling methods now in use in the industry.

Scale drawings of the layouts and cross sections of the six plants have been completed. Data have been obtained through time studies of labor and machine requirements for handling three general package types into, within, and out of each warehouse as performed with currently owned equipment. In making the studies, attention was given to transportation distances, size or capacity of equipment, stacking heights, height and width of platforms, and height and width of doors, to find out their influence on the productivity of labor. Time studies of pertinent materials-handling operations have been analyzed, and the revisions in methods called for in the contract are nearly complete. Reports to the six individual warehouses, also a requirement of the contract, are currently being prepared and will be ready for discussion with the managers of the warehouses during August 1952.

A final report will be submitted by the contractor during the first half of the fiscal year 1953. This report will cover all appropriate contract provisions and will include the development of standard time values for performing materials-handling operations, cost of ownership and operation of equipment, and other related information and data dealing with materials-handling problems in public refrigerated warehouses. This report will serve as a basis for the preparation of a Department publication on materials handling for the refrigerated warehouse industry. No interim reports have been published in connection with this project.

COTTON WAREHOUSES

During the year visits were made to 171 cotton warehouses in 85 different cities located in 10 different States in the Cotton Belt. During these visits 213 time studies were made of various cotton-handling operations.

In the field work conducted during this period emphasis was placed on filling in gaps which remained in information obtained from studies previously conducted. However, considerable attention was given to obtaining a broad and general coverage of handling problems in small warehouses, such as those in the Southeast, in order to plan field work in such warehouses during the 1952-53 season. Because of limited time it had not been possible in previous studies to cover many of the smaller warehouses. Also, attention was given to the study and evaluation (not yet completed) of several innovations in materials-handling equipment which were recently introduced into the cotton warehouse industry. Preliminary investigations suggest that some of this equipment may be the means of effecting substantial economies in certain kinds of bale-handling operations.

In March 1952 a report entitled, *Some Improved Methods for Receiving Bales of Cotton in Compresses and Warehouses*, was issued. This report was the result of bringing together and unifying in a single publication discussions of several improved cotton-handling methods which were originally scheduled for release in a series of shorter reports. Among the improved methods discussed in this report are the unloading of railroad cars and motor trucks by industrial lift trucks, the employment of temporary or "floating" blocks of bales between the various operations of a receiving cycle, the use of a mobile beam scale for weighing flat bales, powered equipment for transporting bales, "block sampling" of flat bales, and an

improved method for integrating the weighing and sampling of compressed bales. It was found that proper employment of clamp trucks for unloading motortrucks from ground level or railroad cars from platform level could reduce the man-hour requirement to about one-sixth that required when manual-hand-truck methods are used. It was also found that when handling flat bales by hand truck the man-hours of labor required to perform a complete cycle of unloading, weighing, sampling, and transporting to storage could be reduced by 20 to 40 percent by separating these operations from one another by means of temporary blocks of bales set up between the operations. This device, where a temporary block serves as a depository for bales as they leave one operation and as a source of supply for bales entering the next operation, makes possible the elimination of much of the delay or idle time which results when the several operations are carried on concurrently and when any one operation in the group can become a bottleneck directly affecting all the other operations. However, the greatest advantage of the temporary block is that it may permit an entire reorganization of the receiving cycle so as to permit the use of the most efficient equipment and methods for each operation. The use of clamp trucks for transporting, a mobile beam scale for weighing flat bales, and an integrated weighing and sampling operation for compressed bales were also found to result in substantial savings.

A report intended as a guide to cotton warehouse managers and foremen in improving their own handling operations has been prepared and will be published during the next fiscal year. Much progress was made in the analysis of materials-handling equipment cost records and other data which are to be included in a report on preventive maintenance as applied to cotton-handling equipment. In accordance with prior agreements, most of the 35 cooperating warehousemen who have made available to the Branch monthly reports on the costs of operating, maintaining, and repairing their materials-handling equipment discontinued such reports after August 31, 1951. However, in order to obtain adequate coverage on certain types of equipment, arrangements have been made with 10 warehousemen to make available the equipment cost records for an indefinite period. Work also has been initiated on the analysis of time studies of compress operations, from which it is expected that a report will be prepared on the effect of rolling bales on the costs of compression and related handling operations.

RESEARCH ON THE PROPER SPEEDS OF TRANSLATION AND ROTATION FOR GRADING PRODUCTS

Farm and food products of several types are graded on the basis of surface characteristics. In grading operations such products are "translated" or run over grading belts or tables and are visually inspected for surface defects, color, and other surface characteristics. To expedite the visual inspection process, some types of grading tables rotate the product as it is being translated past the grader. A problem in packing plants that grade products through visual inspection is in determining the speeds of translation and rotation that will obtain the desired qualities of these products with minimum labor requirements. In connection with this problem it has been found that in grading some products, when the rates of translation and rotation are at certain speeds, the graders may become somewhat nauseated or "white out" and permit all products to pass them without removing or sorting

defective or lower grade items. Another problem in achieving greater labor efficiency concerns the design of grading tables--that is, whether greater efficiency is achieved when products are translated in single rows or in multiple rows. The proper direction of approach of the product to the grader is another problem which faces packing house operators in achieving greater labor efficiency.

The purpose of this project is to increase the efficiency of labor used in grading operations involving the visual inspection of products by determining: (1) The optimum speeds of translation and rotation of products of various shapes, sizes, color contrasts with those of defects, types of defects, and number of defects; (2) the comparative efficiency of single-row and multiple-row arrangements for the translation and rotation of products; and (3) the proper direction of approach of products to the grader. A subsidiary purpose is to provide basic data required in developing more efficient grading tables.

Work on this project was inaugurated in July 1951 under the provisions of a research contract with the Institute of Engineering Research of the University of California. This contract provides for laboratory tests with wooden objects of various sizes, colors, etc., simulating different types of farm and food products, and for field tests with three products to be selected. The following results of laboratory tests with ellipsoids are illustrative of the results of tests with objects of other shapes:

1. A rotational speed of approximately 0.8 revolutions per foot of translation *per row of objects passing the inspector* is required for satisfactory inspection when the objects being inspected approach the inspector from the side. When direct approach is used, the rotational speed may be slightly less.

2. When end defects are not present on ellipsoids, direct approach is slightly more effective than side approach.

3. The use of mirrors was found to be of some value in inspecting for end defects when slower translational speeds were used (3.7 minutes to inspect 1,000 specimens). At higher inspection speeds (3.0 minutes per 1,000 specimens) the mirrors were no help. At the best an inspection efficiency of 95 percent was obtained. This was with ellipsoids containing 30 percent defects. One-third were end defects; 4/9 were between the minor diameter and the end; and 2/9 were at the minor diameter.

4. Without the use of mirrors and with end defects, at faster speeds side approach is not as effective as direct approach. At slower speeds direct is better when more than 3 rows are being inspected simultaneously.

5. When end defects are present in the amounts indicated above, the maximum inspection efficiencies obtainable at comparable production rates are about 4 percent less than can be obtained with no end defects.

6. With end defects and for a 95 percent inspection efficiency, a production rate of 1,000 ellipsoids in 3.0 minutes appears to be practicable. This compares with a 2.3 minute rate when end defects are not present.

All laboratory tests have been completed, and at the end of the year packing house tests were under way. The products selected for these tests are long-white potatoes, lemons, and oranges. The contract provides that a final report shall be submitted on or before October 1, 1952. No interim reports in connection with this project have been published.

FUNDAMENTAL RESEARCH DESIGNED TO ISOLATE AND MEASURE COMPONENTS OF WORKER PRODUCTIVITY

The purpose of this project, begun in June 1951 under contract with the New York State College of Agriculture, is to determine the degrees of skill and effort involved in individual basic motions, to classify them accordingly, and to establish standard time values for basic motions involved in agricultural marketing processes. Such data are needed to improve the accuracy and utility of efficiency studies of agricultural marketing operations.

Prior to beginning work on this contract several hundred feet of 16 mm. motion pictures were recorded of apple-packing and egg-handling operations. These were microanalyzed in order to obtain a catalog of motions used in the handling of these commodities. Since the beginning of this project additional micromotion pictures have been made of grading roses; packing tomatoes, cauliflower, celery, onions, lettuce, and potatoes; loading celery; prepackaging coffee and macaroni; filling and lidding peanut butter; filling and stitching flour bags; loading bottle washers in milk plant; filling cheese cartons; washing pipe and milk cans; receiving milk; filling crates of milk; loading and unloading milk cans from truck; wrapping and sacking bread; packing doughnuts; packaging meat and cheese; checking out groceries; making up egg cartons; candling eggs; stocking shelves in grocery stores; handling cans in canning factory; grading beets; weighing cans of beets; packing cans in case; gluing cases; and unloading empty cans from railroad boxcars. These latter films amounted in all to 3,100 feet. They are providing a necessary variety of motion classes, with subclasses according to sizes, weights, and shapes of objects handled, to draw from in setting up the tables of motion-time data. Because all commodities cannot be studied in detail, it is planned to select objects in class intervals ranging from the size of an egg to approximately the size of an apple crate in reasonable progression from one class interval to another. It is believed that enough different sizes can be included in the final table to provide satisfactory data for application to items included within the range of sizes given above. Although many operations have been obtained on film for the purposes mentioned above, it is likely that some others will be added from time to time throughout the project period. It is estimated that this phase of work is 90 percent completed.

The films of actual work operations mentioned above are being analyzed to provide a catalog of the motions used. Thus far the motions used in apple packing, egg handling, and stocking grocery shelves have been cataloged. The operations studied have revealed types of grasp which are not included in tables for motion-time standards compiled for industrial work.

A table of motion-time data for apple- and egg-handling operations is partially completed. This table, when finished, will serve as a base table, and motion classes

will be sought in the handling of other commodities which differ from those included in this base table. Motions which are identified as being the same as motions used in apple and egg handling are being compared to insure that they actually are the same; however, the principal effort is toward finding new motion classes which exist in handling these other commodities.

Since one purpose of this project is to provide a table of time values to be used in appraisal of alternative work methods, it is necessary to test some motion combinations which are not found in actual use but which could very well be used. This has been done in both apple and egg handling and is a consideration for all work operations being studied.

In the final selection of commodities to be studied intensively these criteria were used: (1) The need for particular motion classes and sizes, weights, and shapes of objects handled to complete the tables, and (2) the volume of the commodity handled.

A further test has been run covering a range in sizes, weights, and shapes of items which are handled by grasping in a single hand. This test required 2,300 feet of film and includes (1) Canned goods running from 11 oz. to 56 oz., (2) glass jars running from 8 oz. to 46 oz., (3) bottles running from 20 oz. to 110 oz., (4) boxes running from 10 oz. to 72 oz., (5) bags running from 8 oz. to 64 oz., (6) round or approximately round fruits and vegetables running from 4 oz. to 48 oz., and (7) bunch vegetables running from 16 oz. to 48 oz.

These tests consisted of a simple cycle (*reach, grasp, move, and position release*) performed at a standard distance of 24 inches. Data taken from these tests indicate the desirability of grouping the smaller sizes, shapes, and weights in the final table insofar as time requirements are concerned. A sample of data taken from these films is given in table 1.

Table 1.--Motion times for handling different sizes of jars (.0005 minute)

Glass jars	24 in. reach	Grasp	24 in. move	Position and release	Total cycle
1/4 pint	22.1	1.4	22.5	1.3	45.8
1/2 pint	22.4	1.5	22.8	1.5	43.4
1 pint	22.7	2.1	24.1	1.5	48.2
1 quart	22.5	2.7	25.2	2.0	52.5

Intensive tests have been conducted and recorded on 16 mm. film for virtually all of the necessary motions for apple packing and egg handling. The films of apple packing amount to approximately 6,100 feet, and those for egg handling approximately 8,400 feet. Some motions have been excluded which, by nature, are machine-timed or which have other restrictions that would make the data meaningless or excessively complex, i.e., decision time in grading which would vary depending upon quality of inputs, number of grade lots, number and kind of grade characteristics, and quality of output.

Approximately 60 percent of the apple-packing films have been microanalyzed. This analysis has provided motion-time data for setting up a partially completed table of motion-times for the work motions used in apple packing. The preliminary films for measuring the relationship of performance time to size, weight, and shape of object handled have been analyzed and provide an invaluable guide in the selection of other commodities.

In determining the best measure of central tendency, a large portion of data taken from films of apple-packing operations was computed on all three bases--mean, median, and mode. These characteristics were observed:

1. When deriving these measures from the motion data of a single operator, the median or mode values for one motion seldom occurred in precisely the same cycles as the median or mode for any other one motion. This interferes with the use of the *reach* motion as an indicator of effort level, since the effort used by an operator at the beginning of a series of work cycles can vary considerably from that applied a few cycles later. This makes the mean a more desirable measure of central tendency.

2. When median and modal values were examined for data conveying a series of progressively longer distances for *reaches* and *moves*, it was found that these data were somewhat erratic. Sometimes the longer of two distances would have a shorter time value than the shorter distance. This seldom occurs when the mean is used.

3. The correlations of *reach* with other motions which occurred in the same cycle were higher for data based upon the arithmetic mean than for either the median or mode. This is perhaps due to the fact that for such data the mean is a more stable figure, not subject to as great influence from one erratic cycle as the other two measures. The correlation of *reach* with *move* using the three measures of central tendency is shown in table 2.

Table 2.--Relationship 1/ between *reach* and *move* time for data based on different measures of central tendency (Data are taken from films of apple-packing operation.)

Distance (inches)	Mean	Median	Mode
8	0.94	0.88	0.81
12 . . . . .	.90	.84	.90
16 . . . . .	.92	.89	.84
20 . . . . .	.94	.88	.78
24 . . . . .	.94	.72	.86
28 . . . . .	.95	.88	.72
32 . . . . .	.94	.89	.94
36 . . . . .	.83	.81	.62

1/ Coefficient of determination.

For the purposes contemplated in this project it has been concluded that the arithmetic mean serves best. This essentially completes work on this problem. However, if evidence in future work indicates the desirability of using either the median or mode, it can be computed from the tabulated data.

As the film of each test is analyzed, the correlations between *reach* and other motions are computed. Several such series of data already have been combined into a preliminary table and the table used for predicting the results of each operator tested, the predictions being based upon the *reach* time value. A sample is given in table 3 in condensed form.

Table 3.--Motion-time values for the motions involved in a simple 24-inch cycle of apple packing
(.0005 minute)

Reach	Grasp	Move	Position and release
9.0	1.20	8.10	1.0
8.5	1.16	7.58	1.0
8.0	1.11	7.06	1.0
7.5	1.07	6.52	1.0
7.0	1.03	6.02	1.0
6.5 . . . . .	.99	5.50	1.0
6.0 . . . . .	.95	4.98	1.0

In making the predictions *reach* values were broken into .00005 minute intervals. For this particular set of data there were eight people who operated at two levels of effort and eight different distances, thus providing for 128 predictions. The accuracy of these predictions is shown in table 4.

Data collected since the start of this project lend further support to the choice of the motion *reach* as an indicator of effort level and as a common denominator. Other motions such as *grasp* and *position* are frequently too short for accurate measurement. The motion *move* is long enough for accurate measurement but is complicated by the influence of size, weight, and shape of object. This is clearly indicated in table 2 herein. The influence of weight is decidedly greater in *move* than in *reach*. In future work efforts will be directed toward identifying and classifying the different classes of *reach* so that its use as a base motion can be further refined.

A suitable operation has been selected for use in making one test of the utility of motion-time tables. In the course of working on the time data, an improved method was developed for layer packing apples. The usual methods either use only one hand effectively or use both hands but require that all apples be handled twice. The improved method permits both hands to be used effectively, and the fruit is handled only one time. It is planned to introduce the improved method in some nearby packing plant during the coming season and to check the actual change in output against the change which may be predicted by using the tables of motion-time data.

Table 4.--Cumulative frequency distribution of deviations of predicted cycle from actual cycle, apple packing time distance test

Percent deviations	Number of observations	Percent of observations
1 and under	33	25.8
2 and under	52	40.6
3 and under	76	59.4
4 and under	89	69.5
5 and under	101	78.9
6 and under	112	87.5
7 and under	117	91.4
8 and under	121	94.5
9 and under	125	97.7
10 and under	125	97.7
11 and under	125	97.7
12 and under	126	98.4
15 and under	128	100.0
Total	128	100.0

Other work has been accomplished which was not foreseen and specified in the contract but which is essential to the project. In both apple and egg operations it has been necessary to build special equipment in the laboratory so that the motions could be performed without any restrictions from machine timing. This is highly important in the meaningful collection of data. Continuous effort to improve the films for better and faster analysis has yielded considerable results. Various patterns of backgrounds have been tried to determine which would reveal micromotions most effectively. Consequently films which are now being made are considerably easier and faster to analyze than those made at the beginning of the work on this project. It is anticipated that still further improvements will be made in this area.

WORK ON WHOLESALING, RETAILING, AND PACKAGING

The Branch conducts research on retailing, wholesaling, merchandising, and packaging food products in order to increase efficiency, reduce costs, improve quality, and increase consumer acceptance and convenience. The research conducted by the Branch recognizes that marketing agencies performing such functions as retailing, wholesaling, and packaging are organized and operated primarily on a functional basis with only secondary consideration given individual commodities. The over-all efficient performance of a function often requires compromising on the handling of individual items.

Research in the general field of retailing, wholesaling, and packaging has been conducted in close cooperation with many individual retail and wholesale firms, as well as with three national trade organizations. All the research projects described below have been recommended and approved by industry advisory committees.

REDUCING THE COST OF HANDLING PRODUCTS IN RETAIL FOOD STORES

Research on reducing food handling costs in retail stores during the year has been concentrated in two store departments: (1) Grocery and (2) service and self-service type meat and poultry markets. Time studies were made of typical operating procedures of these departments in retail stores with different volumes, equipment, methods, and location conditions. After the standard methods of performing the work were studied, improvements were developed and tested.

Check-out Operation

In a previous report it was pointed out that the Branch had developed a new check-out counter, the use of which increased the productivity of the check-out operation by about 38 percent. Although no effort has been made to determine the full extent of the adoption of this counter, it is known that by the end of June 1952 more than 3,000 were in use. The experience gained with this counter has made it possible to develop further improvements. As the year ended, the Branch was in the process of constructing a counter incorporating these improvements, preparatory to installing and testing it in several stores.

Grocery Handling

The objective of one phase of research was to determine more efficient methods of receiving, checking in, price marking, and shelving groceries in retail food stores. This work was conducted in cooperation with a national chain-store organization in outlets in the eastern part of the United States. The study has been completed and a report, *Some Improved Methods of Handling Groceries in Self-service Retail Food Stores*, was issued in June 1952.

The improved methods and equipment developed for the four operations covered by this study resulted in increased productivity in these operations by 67 to 87 percent. The most productive method of receiving involved the use of a minimum size

crew and wheel-type gravity conveyors. Checking the order in and unit pricing each case after the order had been stacked and segregated by commodity groups in the storeroom was more productive than former methods. The most productive price-marking system analyzed involved stamping the prices at the shelves on items which had been obtained from segregated commodity stacks in the storeroom. A self-inking price-marking set attached to the handle end of each four-wheel stocking truck was used. Cases to be stocked on the bottom shelf were moved from the truck to the floor in front of the item location and opened and price marked in this location. Cases that were to be stocked on the middle and top shelves were opened and price marked on the four-wheel hand truck. The highest production per man-hour for stocking shelves was obtained by the use of a new leaf-type sliding shelf, installed as a part of each three-foot section of display shelves to support the case of merchandise during the shelving operation and by the use of four-wheel hand trucks for carrying cases from the storeroom to the shelves.

Meat- and Poultry-Handling Operation

The objective of a second phase of the research was to determine, through the application of motion and time study techniques, improved methods, equipment, materials, and layout in retail meat departments in order to increase labor productivity and reduce labor costs. The research under this project was closely coordinated with the work on prepackaging meat so that the entire meat operation in both self-service and service-type markets was covered by the two research projects. The research has been conducted in cooperation with two large chain-store organizations in their retail outlets located in the southeastern portion of the United States. Nearly all the data have been collected, and much of the analysis has been completed. Reports on the research will be written and published during the coming year.

A completed analysis of the meat receiving blocking operation included studies of (1) receiving by hand compared to receiving on the rail, (2) evaluation of the meat rail, (3) evaluation of the meat hook stabilizer for easier receiving, (4) blocking on the block compared to blocking on the rail, (5) improved blocking methods, and (6) use of the power saw in blocking.

Time studies were made of 35 representative meat items for the entire cutting operation in service and self-service meat markets. Improved layout of cutting rooms to eliminate double handlings and minimize walking and transporting distances was developed. Included in the study were such evaluations as (1) cooler floor at cutting room level, (2) foot-operated opener for cooler door, (3) foot switches for power saw and mill, (4) comparison of hand cutting methods with use of power saw, (5) evaluation of the use of a slicer on some cuts of meat, (6) development of a simple device to remove the spinal cord, (7) knife calibrated as a ruler for blocking and cutting, (8) holes in cutting table for disposal of trimmings and bones, and (9) hand saw-knife combination for cutting certain items. A piece of equipment was developed and tested to remove the smear from meat, which increased productivity for the cutting operation by about 25 percent over former methods. This piece of equipment will soon be available to the trade at a reasonable price.

Methods of increasing the productivity of displaying 50 representative retail cuts of meat in various types of self-service and service-type cases were studied. New and more productive practices were developed and tested. "U"-shaped and semi-circle service counters were installed and tested for productivity on display and customer service operations. Pricing improvements for previously prepackaged items very substantially increased productivity of this operation.

An analysis of customer service in service-type markets was made. Methods were developed to improve paper yields and methods of wrapping. Improved work-place arrangements were developed. A complete analysis of handling special orders in service and self-service stores was made.

Several meat departments were redesigned in accordance with layout principles developed during the study, and the over-all productivity of labor in these departments was increased by more than 40 percent.

Produce-Handling Operation

The objective of a third phase of research is to develop improved methods of handling produce in service and self-service type retail food stores. A survey of firms reported to have some of the best produce-handling operations in the United States has been made, and cooperators have been selected for the project. Some preliminary work has been done toward getting the work started.

PREPACKAGING MEAT, POULTRY, AND OTHER ANIMAL PRODUCTS

Fresh meats and animal products are being prepackaged primarily to make them suitable for sale on a self-service basis. The number of stores with complete and partial self-service meat departments has substantially increased during the year. Since the prepackaging of meat and poultry is a relatively new operation, there are many opportunities to improve upon present methods, layout, equipment, and merchandising practices.

Improved Efficiency in Prepackaging Meat

The objective of current work is to assist retailers in developing and adopting efficient methods of prepackaging meat in self service food stores. The research under this project was closely coordinated with the work on service-type meat markets so that the entire meat operation in both self service and service-type markets was covered by the two research projects. The research has been conducted in the Southeast in cooperation with two large chain-store organizations. Most of the data have been collected and analyzed. Reports on the work will be written and published during the coming year.

Motion and time study techniques were used to determine the most efficient methods, equipment, and layout for packaging and displaying 45 representative cuts of meat. Various types of scales were analyzed to determine accuracy and speed. Price marking and labeling were studied to develop the most efficient methods and equipment. The yields and costs of various films were analyzed. General rules for

selecting sizes of and proper materials for packaging were developed. Methods of wrapping meat were analyzed in order to determine the lowest net cost per package considering labor and material costs. New equipment was developed for wrapping and weighing stations.

New wrapping materials have become available within the year. The window-type carton has been extensively tested. Consumer acceptability of the carton was found to be favorable, labor costs of wrapping were considerably less than films, and material costs higher than film. One store has been completely converted to the use of cartons, and the collection of data is being continued. The effects on productivity, film usage and over-all costs of the use of Thermoplastic treated boards have been studied. Favorable results were obtained on performance tests run on several types of preformed bags.

Costs of Rewrapping Meats, Poultry, and Cheese

The objective of this phase of research was to assist retailers in reducing the costs of rewrapping prepackaged meats, poultry, and cheese. The study has been completed, and a report, *Costs of and Reasons for Rewrapping Prepackaged Meats, Poultry, and Cheese*, was issued in November 1951.

Results of the study show that an average of 7 to 11 percent of the different types of meats requires rewrapping. The cost of rewrapping ranged from 0.3 of 1 percent of cheese sales to 1.1 percent of lamb sales. Price changes and unattractive packaging were consistently two of the principal reasons for rewrapping all types of meat. Discoloration caused considerable rewrapping of beef, pork, veal, lamb, and cold cuts. Broken film was an important cause for rewrapping beef, pork, lamb, veal, and poultry. Spoilage caused 3 percent of the packages to be removed from display and was relatively the highest for lamb.

The average cost of rewrapping was 2.7 cents per package. Labor cost averaged 58.8 percent of the rewrapping cost; film cost, 21.5 percent; tray cost, 10.6 percent; and backboard cost, 9.1 percent. The cost of rewrapping amounted to an average of 0.25 percent and the loss by spoilage to 0.23 percent of the sales value of all meats, poultry, and cheese displayed.

The most effective way of reducing rewrapping is to maintain a high rate of turn-over by ordering and wrapping meat in line with current requirements. Rewrapping due to price changes may be reduced by using outside labels or changing the label by slitting the film. Discoloration is reduced when meats have gone through a blooming period, have a good turn-over, and are properly refrigerated. Fading is reduced when some technique is used to reduce the amount of light exposure. Unattractive packaging, as a cause for rewrapping, can be reduced by properly trimming and wrapping the meat; using trays for cuts such as liver, kidneys, and brains; and allowing free fluids to drain before packaging. Film breakage can be reduced by the selection of the proper film, use of proper sealing temperatures, and removal of sharp and excess bones.

IMPROVEMENT OF MERCHANDISING METHODS AND PRACTICES IN WHOLESALING AND RETAILING

The three lines of research conducted in the improvement of food merchandising and practices are: (1) Cooperation between wholesalers and retailers to increase efficiency and lower costs for both groups, (2) efficient utilization of store selling space and equipment, and (3) development of more efficient and effective personnel hiring and training practices. All of these lines of work were recommended and given high priority by the Food Merchandising Advisory Committee.

Wholesale-Retail Cooperation in Food Distribution

The objective of this research is to analyze methods of improving and strengthening cooperation between wholesalers and retailers where such cooperation can increase efficiency and lower food distribution costs. During the year two studies have been completed.

A study conducted in cooperation with the National American Wholesale Grocers' Association was made to determine some of the methods that leading wholesalers are using in helping retailers to sell more groceries at lower costs. Available evidence indicated that the operating costs of firms offering a number of services to retailers are not necessarily higher, and may be lower, than those of firms which offer few services. The services most frequently performed by wholesalers for their retail customers include the furnishing of informational aids, promotional aids, store engineering assistance, and store management guidance. Other types of services offered by some of the wholesalers were accounting assistance, financial aid, real estate advice, insurance service, employment service, and retail training. The wholesalers attributed much of their success to the practices described in detail in the report. It is expected that other wholesalers may be able to improve their operations by adopting some of the practices. In June 1952 a report entitled, *How Some Wholesale Grocers Build Better Retailers*, was issued.

A survey was conducted in cooperation with the U. S. Wholesale Grocers' Association to determine how wholesalers can reduce the cost of taking, handling, and delivering orders. This study showed that some wholesalers are attempting to hold down costs of taking sales orders by (1) Reducing the amount of work done by salesmen through the use of pre-printed order forms, (2) increasing the size of orders at each call, and (3) eliminating calls for unprofitable orders. The efficiency of the order assembling operations has been increased through improved stock arrangements and physical arrangements in the warehouse which help obtain optimum utilization of the warehouse force and equipment. Delivery costs have been reduced through the cooperation of retailers in decreasing the number of deliveries and the time spent in truck unloading as well as by improving truck routing and making some utilization of common carriers. A procedure was developed for more accurately measuring the performance of drivers without recourse to logs or recorders, which, when put to use, decreased the drivers' time by more than 10 percent. The survey of wholesaler operations pointed out that (1) The cost of many wholesaling operations can be reduced, and (2) the surface has just been scratched in uncovering ways of doing these jobs more efficiently. In June 1952 a report entitled, *Methods of Handling and Delivering Orders Used by Some Leading Wholesale Grocers*, was issued.

A questionnaire for the purpose of surveying the retail customers of the wholesale grocers studied has been prepared. This survey will furnish information on: (1) Which aids made available by the wholesalers are actually being used by their retailers; (2) what suggestions the retailers have for making the wholesalers' aids more useful; and (3) how acceptable to the retailers are certain trade proposals for reducing wholesaler operating costs--for example, delivery. This information will be correlated with data obtained from the case studies of wholesalers.

As a result of developing a procedure for measuring the performance of truck drivers, grocery wholesalers have requested that standards be developed which could be used by the grocery wholesaling industry. Information is being obtained from several representative operators, and standards are being developed.

Efficient Utilization of Store Selling Space and Equipment

The general objective of this research is to improve the efficiency of departmental display space in retail food stores. During the year the relation between the number of rows of an item displayed on a shelf to the sales of canned fruits and vegetables has been studied. A survey of 22 supermarkets showed that a considerable difference of opinion and practices exists among food retailers regarding the quantity of grocery items displayed on store shelves. A controlled experiment, conducted in 5 supermarkets located in an eastern metropolitan area, was designed to compare the sales of 17 selected canned fruit and vegetable items from 2-, 3-, 4-, 5-, and 6-row displays. The data have been analyzed and a first draft of the report written.

The results show an average change in sales of about 10 percent for each row added to a 2-row item display. The average sales and gross margin per unit of display space (row or foot) with a 2-row display exceed about 5 to 1 the additional sales or gross margin per added unit of display. Although individual item sales increased or decreased an average of 10 percent per row, the net store sales of canned fruits and vegetables probably changed considerably less since there probably was substitution by the customer of one item for another. Estimated results from applying conclusions of the controlled experiment were obtained by a proposed modification of the present canned fruit and vegetable displays in two typical supermarkets. Possible savings in shelf space of 36 and 41 percent and increases of average gross margin per shelf foot of \$0.74 and \$0.82 are indicated. These savings in shelf space and increases in gross margin probably could be obtained at very little loss of store sales of canned fruits and vegetables. Shelf space saved could be used to stock items returning higher gross returns than the space was previously returning.

A new study to evaluate the effect on store sales of special displays used in retail food stores has been started. Special displays occupy valuable selling space in most stores and require many man-hours to construct and maintain. Unless these displays increase store sales sufficiently to compensate for their costs, perhaps they should be replaced by regular displays. The objectives of the research are to determine: (1) The effect on store sales of special item displays, (2) the relative returns per square foot of selling space of the special displays compared to shelf

displays, (3) relative effectiveness of multiple item displays, (4) the effective life of displays, and (5) the carry-over effect on sales of special displays. The research is being conducted in the supermarket outlets of a local chain in an eastern metropolitan area. The collection of data will continue for several months.

Development of Improved Training and Supervision Techniques

A new line of research started during the year has for its purpose the developing of better techniques for training retail food store employees and the determining of the relative effectiveness of different training methods. A need for this type of research has often been demonstrated when an attempt is made by the store management to put into operation some of the new ideas and equipment developed by the Department and others. Through the application of the improved training techniques it is expected to reduce training costs, increase employee productivity, and thus reduce or hold down the cost of retailing food.

The research is being conducted in cooperation with two local supermarket chain organizations located in two eastern metropolitan areas. The collection of data from one supermarket group has been completed. The present training practices followed by this organization have been observed and their effectiveness measured. Modifications of the present practices have been made, employees trained by use of the new methods, and the training results measured. Preliminary analysis of the data indicates that significant gains can be achieved in productivity, accuracy, and employee satisfaction through the improved training techniques tested. Research with the second group of supermarkets has been started, but the collection of data is not completed.

TRANSPORTATION FACILITIES, EQUIPMENT, AND LOADING METHODS

Research in the transportation of agricultural commodities carried on by the Branch during the year followed three general lines of work: (1) Better utilization of carrier equipment; (2) improvement of the various types of transportation equipment in use and in the facilities for loading and unloading; and (3) research in the methods of stowing, bracing, and shipping, including a study of the use of palletized containers.

The annual report of the Branch for fiscal year 1951 discussed the changed conditions in transportation that followed the outbreak of hostilities in Korea, which required a shift in emphasis on some of the research work in progress during that year.

Since that time, although conditions have become somewhat more stable, the expected production goals for transportation equipment have not been realized due to materials shortages. Consequently, the problems created in the field of transportation research remain and some of them have become intensified.

The production of needed railroad cars declined from 9,000 cars per month in May and June 1951 to an average of approximately 6,500 cars per month in the 6-month period January through June 1952. This decline in production of cars may be attributed to curtailed allocations of steel for the car production program. However, by holding down retirements of old cars, the railroads were able to register a net increase of 40,000 cars in their ownership during the year. In view of current policies designed to overcome the lag in defense production due to the recent strike in the steel industry, it seems doubtful that steel allocations for new freight cars and major repairs will be adequate to offset necessary retirements of old freight cars in the months immediately ahead.

Another effect of the steel strike may be to release a flood of demands for freight cars for transporting many nonagricultural commodities when output is resumed, the production of which has been slow because of lack of steel. If this should coincide with the usual high demand for boxcars in October, partly created by the need for cars for crops harvested in that period, the result may be a car shortage of some severity. However, the decline in the demand for boxcars during the period of wheat harvest in June and July 1952 probably assisted greatly in minimizing shortages of cars for grain loading and in the orderly movement of the crop.

UTILIZATION OF CARRIER EQUIPMENT

Prompt railroad services in the transportation of products of the farm are always of concern to the shipper. First, when the product is to be moved, the shipper wants a good, clean, tight car adequate to protect the commodity. Second, he wants it available on the day he plans to load. Third, he wants dependable prompt service in its movement to the place of sale. Delay, either in furnishing a car for loading or in the movement, may cause the consignment to miss a favorable market. Speed of transit and dependability of schedule are equally important to processors and distributors of farm products in holding inventories to a minimum.

From the standpoint of the carriers, efficient utilization of equipment is necessary to avoid car shortages and to keep to a minimum the number of cars that have to be built and maintained to carry the railroad traffic of the Nation. It is estimated that if a saving of only 1 day were made in the average turn-around time of railroad cars--that is, the time from one loading to the next--the resulting improvement would just about equal the present shortage of 86,000 cars, by which amount the freight-car production program laid down in 1950 is short of its goal. Moreover, such increased efficiency in the utilization of freight cars would avoid the investment of over $\frac{1}{2}$ billion dollars in new cars, with recurring annual charges to the railroads of better than 50 million dollars. It would also significantly ease the pressure of competing with essential defense production for steel and other critical materials.

The annual report for 1951 reported on a new railroad operating efficiency index developed by the Branch, called a *movement ratio*, to be used primarily as a guide for operating policy by individual railroads. This statistical unit shows the ratio of time in transit that the average carload actually moves in a freight train. It also indicates the percentage of total transit time that the average loaded car is delayed in terminals. The *Staff Study* which described the proposed index, its formula, and possible applications on a single railroad system was sent to the presidents of approximately half the Class I railroads in the country, together with an analysis of the movement of 36,000 carloads of agricultural commodities, to prove and illustrate the formula. Analysis of the 36,000 sample carloads showed a movement ratio of 25 percent with cumulative terminal delays being 75 percent of transit time.

During the current year considerable interest in the proposed statistical unit was displayed by railroad executives and by several large shipper organizations who were furnished a copy of the *Staff Study*. The National Council of Farmer Cooperatives, for example, appointed a committee to conduct an organization-wide survey of terminal delay and to apply the formula to carload shipments made by participating members during a 3-month test. The results of these terminal delay studies in which the proposed index was applied were made available to the particular railroads which handled the carload movements surveyed, and remedial action is being taken where possible. Recently joint railroad and shipper Car Efficiency Committees of Shipper Advisory Boards have renewed an earlier interest in the potential uses of the proposed car efficiency index by placing it on the agenda for discussion at their meetings.

The railroads have shown a positive interest in the work of the Branch in improving freight-car utilization. Indicative of this interest is the action taken by the American Railway Engineering Association, an affiliate of the Association of American Railroads. It has set up a committee of railroad operating officials to make an intensive study of terminal delays. The Association has invited a member of the Branch to become a member of the American Railway Engineering Association and to work actively with its committee. The committee has conducted surveys and tests at several large terminals over the country in an endeavor to crystallize the many factors involved in the complex over-all problem as a first step toward remedial action.

Notwithstanding certain statistical deficiencies, the movement ratio formula is generally conceded to be one of the best measures of operating railroad performance yet devised. Its real worth lies in the possibility that it may be used to measure railroad performance at all levels of operation, from the industry down to the division level of operations. The practical problem now being tackled by the Branch, in cooperation with the railroads and other agencies, is to refine this tentative yardstick by developing simplified sampling techniques for collecting car data and encouraging the railroads to use the formula or an adaptation of it best suited to their specific needs. Terminal delay of agricultural products is inseparable from delays of other commodities transported by the railroads. Thus the problem of minimizing delays to loaded and empty freight cars is basic to railroad operations and one most difficult of solution. Terminal operating methods of long standing are oriented to line-haul freight train movements between terminals. They are both adapted to, and the outgrowth of, the railroad facilities employed; operating practices which have become traditionalized; shippers' requirements; employee working rules; or are prescribed by law. While the over-all problem is one primarily for the railroad industry to solve, the Branch welcomes the opportunity to work with the industry on this problem which is so important to the efficient and expeditious movement of agricultural products.

IMPROVEMENT OF TRANSPORTATION EQUIPMENT

The safe and efficient transportation of agricultural commodities depends heavily upon the type of equipment furnished by the carrier. Ideally, a particular type of car or truck should be adapted to the movement of a wide variety of commodities. The railroad refrigerator car, for example, must be suitable for eggs, butter, cheese, dressed poultry, beverages, fresh and frozen meats, other frozen foods, many different kinds of fresh fruits and vegetables, and other foods of a perishable nature. It should be capable of giving adequate protection from loss, damage, or deterioration to all of these commodities. Equipment should be of a size and capacity to transport an economical unit of sale, and it should be so constructed that loading and unloading may be performed efficiently and at a low cost.

The same general qualifications must be met by refrigerated motortrucks and truck trailers and by other types of equipment used by the railroads, motor carriers, and water lines for the transportation of nonperishable agricultural commodities.

Railroad and Motortruck Refrigeration Equipment

In the search for new and improved methods of protecting perishable agricultural products from heat and cold while in transit, considerable work was done during the year to improve the control of temperatures in refrigerator cars. A laboratory-controlled test was made of a new method of dry ice refrigeration at a car-testing laboratory at Potomac Yards, Va. The laboratory temperature was held at 85° F. for 10 days to simulate a transcontinental trip during the heat of summer. The car was equipped with a dry ice system of refrigeration with only one moving part, a float valve. The bunker was iced to capacity with 12,000 pounds of dry ice, which held satisfactory temperatures for the 10-day period with no re-icing. The results of this test indicated that from the standpoint of temperature maintenance

the dry ice system of refrigeration was equal to or slightly better than mechanical methods of refrigeration. Based on an actual cost of \$63 per ton, however, the cost of the amount of dry ice used was \$437.22 compared with the tariff rate of \$158.70 for a similar service using new mechanical refrigerator cars. The higher cost of the dry ice system eliminates it, for the present at least, as a practical method of refrigeration in rail transportation. A report on this test was published and circulated to the industry.

A highly significant result of the above laboratory test was the adaptation of this system of refrigeration by the equipment manufacturer to motortruck trailers in accordance with the technical standards and specifications of design and construction recommended by this Branch. A pilot refrigerated truck trailer is now under construction and will be available for road tests in August 1952.

A previous report summarized the results of tests conducted with a view to providing uniform temperatures for frozen foods at 0° F. transported in refrigerator cars by different methods of refrigeration. These tests were made in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering. This work was continued during the current year for the purpose of developing new and improved methods of refrigeration of frozen citrus concentrate from Florida to northern markets. Experiments were made with two types of mechanical refrigerator cars--one car equipped with gasoline-powered units which delivered the cold air into the car under the floor racks, and the other operated by a single diesel engine which delivered the cold air over the top of the load. In order to obtain a measure of the refrigerating efficiency, refrigerator cars using water ice and salt were also used in the tests.

During the current year this study was expanded to include tests on the transportation of frozen foods by refrigerated motortruck trailers. In a number of instances it was found that the mechanical refrigerating units had ample capacity; however, due to inadequate floor and wall racks, the cold air could not circulate completely under the load, causing higher temperatures in certain locations. This defect was largely corrected by the use of a return air duct and a slight modification in the method of loading. The results of the over-all test program and recommendations for improved methods of refrigeration were reported in Agriculture Information Bulletin No. 62, entitled *Transportation of Frozen Citrus Concentrate by Railroad and Motortruck from Florida to Northern Markets*, June 1951, and subsequent reports. The recommended improvements have been adopted with satisfactory results by one of the larger citrus concentrate processors which operates its own truck equipment and one motor carrier.

A new application of dry ice refrigeration for motortrucks has been developed, and at the request of one of the processors of citrus concentrate a transportation test was conducted from Florida to Chicago. In this system of refrigeration a metal cabinet, having a capacity of 600 pounds of dry ice, was installed in a standard 30-foot trailer. Electric fans were located in the top of the cabinet to circulate the air over the metal surface around the load. It was found that supplementary amounts of dry ice had to be placed in the body of the trailer to maintain satisfactory temperatures. The manufacturer of the refrigeration unit is now constructing a

larger cabinet of greater capacity. A test of the new equipment will be made in July or August 1952.

On the basis of the experience gained from the experiments on frozen citrus concentrate, transportation tests were made during the year of motortruck refrigeration equipment when used for transporting frozen poultry from points on the Eastern Shore of Maryland to Chicago, Ill., and Detroit, Mich. Standard stainless steel 30-foot truck trailers equipped with mechanical refrigerating units were used. In two of the tests one truck was equipped with a return air duct using a modified method of loading, while a second trailer was loaded and refrigerated in the conventional manner. It was found that temperatures in the trailers using the return air duct and modified method of loading averaged approximately 4 degrees colder than the trailers not so equipped and loaded. Due to this improvement in commodity temperatures, one of the largest processors of frozen poultry requested that the Branch prepare a progress report on these tests so that the information could be made available to the motor carriers hauling their products for use in converting their equipment. Additional transportation tests comparing different types of refrigeration and trailers are planned.

This year a series of transportation tests were begun on fresh and frozen meat and packing-house products at the request of meat packers. Three rail transportation tests have been conducted from Wisconsin to Philadelphia, Pa., and one test from Minnesota to Newark, N. J. Additional tests will be run for the study of the efficiency of various methods of protecting these shipments and their relative costs. It is expected that a complete report of the results will be available to the industry during the coming year.

One of the fundamental reasons for improper handling of perishable agricultural products in transit is the lack of information or knowledge by the motor carrier and the operator of refrigerated trucks of the characteristics of agricultural commodities and proper methods of protecting them from heat and cold. Industry representatives have recommended the preparation of a handbook which will set forth the principles and practices for the proper handling of perishable commodities while in transit. During the year a considerable amount of information on the subject has been gathered, and work on the handbook was begun. This publication will set forth recommendations for the proper handling of perishable goods in transit from the producer to market. It will deal with such subjects as precooling, loading methods, transit temperatures, weights, and measures, as well as a brief outline of the inherent characteristics of different foods which are of importance in protecting the commodity from loss or deterioration. The handbook is being written in clear and concise language in order that its greatest use may be realized. It is expected that the first edition of the handbook will be available to the trade in the spring of 1953.

Grain Transportation

By railroad: Special study has been given during the year to the basic characteristics of the transportation of grain moving by railroad. The principal points considered in this research are: (1) Analyses of the volume of production and sales

of principal grains; (2) the location of producing areas and markets; (3) the effects of location, volume, and seasonality of production and movement on boxcar supply and distribution for grain transportation; and (4) traffic patterns and length of haul for various grains and their effect upon shortages of carrier equipment for transporting grain. Another purpose of the study is to determine the fundamental transportation characteristics of the grains in relation to changing marketing patterns and to obtain knowledge of how these changes in marketing may be met and aided by improving carrier equipment, facilities, and practices in the transportation of grain. A report on this study is being prepared.

Attention also has been given to improved boxcar design and low-cost boxcar unloading equipment. Contacts have been made with equipment manufacturers, and satisfactory progress has been made to date in obtaining their cooperation in designing proposed new equipment. It is expected that during the coming year the rail carriers can be approached in this enterprise.

By motortruck: A study of the transportation of grain by motortruck in the Southwest was completed and a report published. This study was designed to develop information that would shed some light on the extent to which the movement of grain to market by motortruck has grown in the Southwest in recent years and to determine the reasons for the diversion of this traffic from the railroads to the motor carrier.

Analysis of grain shipments and receipts at 117 elevators and mills in New Mexico, Oklahoma, and Texas disclosed that 77 percent of them used motortrucks along with railroad facilities for shipping and receiving grain. The percent of grain trucked ranged from 33 percent for country elevators to 16 percent for feed mills. Analysis of truck rates showed them to be substantially lower than rail rates between identical points of origin and destination, in some cases as much as 50 percent lower. An important part of this study was the determination of the reasons for diversion of business from the railroads to motortrucks. The reasons given by shippers for this diversion were: (1) Lower rate, (2) better service, (3) boxcar shortage, (4) lower handling costs, and (5) to increase the volume of grain shipped. Principal shipper objections to the trucking of grain were: (1) Unethical business practices, (2) disruption of existing marketing channels, and (3) lack of transit privileges.

The type of equipment generally used in over-the-road transportation of grain and the usual method of unloading are illustrated in figure 4.

Prior to the completion of this study little information was available to the trade on the nature, scope, and methods employed in the trucking of grain. The report not only serves to shed light on this comparatively new development in grain marketing but also points up in an objective manner improvements needed and desired by shippers in the movement of grain by rail.

There is widespread interest shown in the report by the grain trade, equipment manufacturers, and transportation agencies. A number of grain companies have asked for the report as a useful guide to management in determining whether or not grain trucking operations would be profitable for them. Upon request of one grain trade



Figure 4.--Grain-truck unloading operation showing a combination truck scale and overhead cable-type of truck lift.

association the methodology used in the report has been made available to and adopted by them for use in a survey of grain trucking in the region served by its members. Moreover, a number of the grain-carrying railroads have requested copies of the report for use at their division level of operations in evaluating or reappraising their transportation services in the light of this new competition. As an outgrowth of this study the Transportation Advisory Committee has recommended that case studies be made of grain-trucking costs, comparative rail and truck rates, and unloading costs.

IMPROVEMENT OF LOADING, BRACING, AND SHIPPING OF PERISHABLE AGRICULTURAL COMMODITIES

The relatively large amount of loss and damage suffered by many perishable and fragile agricultural commodities from mechanical injury during transportation is one of the major contributing factors to the comparatively high cost of shipping and marketing these products. These losses are important not only from the standpoint of the part they plan in determining the ultimate costs of the transportation but also from the standpoint of the amount of spoilage and waste that may occur in subsequent marketing channels. Past research experience has demonstrated that a substantial part of this unnecessary waste can be effectively eliminated through the use of improved methods of loading, bracing, and stripping shipments of these products

The research carried on by the Branch in this particular field consists mostly of developing and testing improved methods of loading and bracing shipments of various commodities. In addition, container and package design and construction, as they are related to efficient loading pattern and methods, were also studied.

The over-all loss and damage situation in the transportation of agricultural perishables did not change much in 1951 as compared with 1950. Total loss and damage claim payments on fresh fruits and vegetables were \$13,810,634 on 723,583 carlot shipments in 1951 and \$13,811,322 on 727,523 carloads in 1950. Claim payments for fresh meat, however, showed an increase from \$1,647,877 in 1950 to \$1,883,706 in 1951 in spite of the fact that 700 fewer cars were shipped in 1951 than in 1950. Total claims paid for damage to shell eggs decreased from \$522,107 in 1950 to \$303,222 in 1951, although there was an increase of 697 cars shipped from 1950 to 1951, indicating a real improvement in reduction of damage in the shipment of this commodity.

Improved Loading and Bracing of Vegetables and Melons

The new container for lettuce and carrots, popularly known in trade circles as the WGA crate, and developed in cooperation with the Western Growers Association, was described in last year's annual report. During the year this container has almost entirely replaced the three other containers formerly used for the shipment of these commodities from western producing areas. A check of the performance of the new container during its first year of usage under actual commercial conditions, compared with the old container which it replaced, has borne out previous test results which demonstrated the ability of the new crate to reduce transit damage and to deliver a greater quantity of salable product at destination. This information, together with that obtained in the previous research leading to the development of the new container, is being incorporated in a report for publication. This report will be released during the coming year.

The work on cantaloup shipments from California and Arizona in cooperation with the Western Growers Association, centering around the development of the on-end method of loading which was initiated during 1950, was continued during the 1951 shipping season. The new method was found to be much superior to the conventional lengthwise on-side method, since it effected a reduction of crate breakage by approximately two-thirds and melon bruising by one-half. About 1,700 cars with crates on end were loaded during the 1951 season, the performance of which confirmed the findings of the 1950 shipping tests.

Preliminary estimates based on the performance of all cars loaded by the on-end divided method in 1950 and 1951 show that the annual savings that may be realized from the use of the new method of loading will total approximately \$2,200,000 on the basis of 1951 shipments. The largest savings, about \$1,400,000 in hauling costs and \$500,000 in damage claims, would accrue to the railroads. The shippers would also realize substantial savings of about \$350,000 in refrigeration costs and \$50,000 in stripping material.

During the 1951 season emphasis was placed on finding easier, less expensive ways of loading, stripping, and bracing the on-end loads. A prefabricated strip

frame placed between the stacks of crates was developed, tested, and used by many shippers during the season. A modified hand clamp truck, capable of carrying four crates of melons on end into the car, where they were set off directly in position in the load, was also developed. A series of time studies to determine the relative amounts of time required to use each method of loading or stripping and to perform different segments of each operation was made during the melon shipping season. A simpler, easier-to-use and less expensive three-strip method of stripping the on-end loads was developed. The results of this work have been released to the trade in an interim report.

With the beginning of the 1952 cantaloup shipping season in May of this year, the work directed at simplification and refinement of the on-end loading method was resumed. Several time studies and approximately 10 test shipments were made before the end of the year. This work will be continued through the 1952 season, which will bring it to completion.

At the close of the western cantaloup shipping season in the fall of 1951 the cooperative research program with the Western Growers Association was directed to the problems of packing and shipping California broccoli and cauliflower. In the research on broccoli, emphasis was placed on finding methods of reducing the loading costs and in effecting better protection of the commodity through more effective use of top ice in the load. It is known that adequate amounts of top ice in loads of broccoli, cauliflower, lettuce, and some other commodities will help prevent breakage in transit by holding the containers in row alignment (fig. 5). A series of test



Figure 5.--(Left) Close-up view of cross section of load of broccoli showing crosswise shift of crates out of row alignment and resultant container damage due to lack of adequate channel ice to hold crates in row alignment. (Right) Another section of load in the same car. Note how crates are held in row alignment by good distribution of crushed ice in channels between crates.

shipments of broccoli in which no crosswise strips were used revealed that the commodity could be loaded in this manner with no more breakage than the regular loads and with some savings in labor and materials costs. A check on the amounts of top ice applied at origin and in transit and a check on the meltage in different locations in the load pointed up the desirability of more even distribution of top ice, particularly when the cars are re-iced during transit. The use of a paper or some other type of shield over the top openings in the bunker bulkheads of the car to retard ice meltage at the ends of the load and provide better protection from misalignment of the containers and consequent hazard of damage in those portions of the load also may be desirable.

Most of the work on cauliflower was aimed at determining the feasibility of using different types of containers, particularly those that would hold more of the commodity, to reduce transportation costs. It was found that the use of somewhat larger containers, together with closer trimming of the heavy jacket leaves around the curd, would reduce the container and refrigeration costs per net pound of commodity shipped. A series of field packing tests with cauliflower in which several different containers were used was carried out. In addition, several laboratory tests, in which transit and wholesale market conditions were simulated, were made to determine the relative amounts of bruising, discoloration, decay, and various other condition factors associated with the use of different containers, methods of trimming, packing, and icing employed. More than 2,000 heads of cauliflower were measured in various producing areas in California during the season in order to develop basic data for possible changes in crate dimensions. A few transcontinental test shipments of the commodity also were completed during the year. The field packing and laboratory tests did not disclose that the condition of the cauliflower would be affected by increasing the number of heads per container, but it remains to be seen whether this will be true under actual transit conditions. Test shipments to determine that point will be carried out in the coming year.

The research on celery transportation and shipping problems initiated during the previous year in cooperation with the Western Growers Association was resumed with the beginning of the new shipping season in the fall of 1951. Eight transcontinental test shipments were completed, and a number of packing and laboratory holding tests were conducted during the season.

Some additional work on lettuce was done during the year. Several packing and laboratory holding tests to determine the amounts of bruising associated with the use of different types of containers were made, and test shipments to determine the relative effectiveness of different loading patterns in preventing crate breakage also were completed.

In connection with the more than 140 shipping tests on various commodities made under this program of work during the period covered by this report, a detailed check was made of the amount and type of damage and container or load failures in each shipment. This information, which is now being cataloged and analyzed, will provide a basis for recommended changes in containers and loading and bracing methods.

Pallet-Type Master Containers

The work begun during the previous year to determine the feasibility of using large, collapsible, reusable, pallet-type master containers to reduce the relatively high damage and handling costs now associated with the bulk shipping and handling of consumer-size bags of oranges, potatoes, onions, and other commodities was continued. Several truck shipments and one rail test shipment, in which large collapsible wire containers were used for bagged oranges, were run from Florida to Newark, N. J., in the late spring of 1951. Based on information developed in these tests, specifications for a new type of pallet crate were developed. Pilot models of the new container, using wood veneer and wirebound construction, were made up by the Package Research Laboratory of Rockaway, N. J., during the fall of 1951. Several packing and handling tests were conducted with these models. In the spring of 1952 three test shipments of bagged oranges by motor truck, in which the new containers were used, were run from Winter Haven, Fla., to Newark. Time studies were made of the assembling, packing, loading, and handling operations. In-transit temperature and refrigeration records were obtained by the Bureau of Plant Industry, Soils, and Agricultural Engineering in both test and check shipments with recording thermometers, and bruising checks of the fruit were made by Department fruit and vegetable inspectors.

It was found that under normal circumstances use of the pallet-type container would substantially reduce the excessive amount of crushed and bruised fruit inherent in the present method of shipping and handling bagged oranges. It was found that the use of the master container with which the experiments were conducted would reduce the number of individual handlings of 5,000 five-pound bags of oranges from 20,740 to 5,156 between the end of the packing line at the shipping shed and the retail store. It required only 26 minutes to load one trailer truck with 52 pallet-type containers containing about 5,000 bags as compared with about 3½ hours required to load an equal number of bags in bulk. However, the substantial savings in the labor and costs of loading and unloading were not sufficient to overcome the cost of the containers and the additional charges for transporting them as compared with oranges in bulk in bags. After some necessary changes have been made in the containers, it is planned to try them in test shipments of oranges from California, where bagged fruit is now shipped in wooden containers instead of bulk-loaded as are the Florida oranges.

Down Beef in Rail Shipments

Research aimed at determining the relationship of loss and damage in rail shipments of dressed beef to the relative amounts of shock and vibration received in transit, conducted in cooperation with the North American Car Corporation, was completed during the year. The information developed in the test shipments run under this program of work, together with that developed in a previous survey of the extent and type of loss and damage in about 3,400 cars of this commodity, has been incorporated in a report now being cleared for publication.

This study revealed that much of the down and damaged beef was associated with a relatively high degree of shock and vibration received by some shipments during transit. Much of the shock and vibration received by the car and transmitted to the

loading was found to be due to rough handling or riding conditions and defective or inadequate maintenance of the running gear of the car. This pointed up the fact that much of the damage now being sustained by this valuable commodity during transportation can be prevented by proper maintenance of the running gear of some refrigerator cars now used for this traffic and more careful handling of the cars by the carriers.

Other Activities

Approximately 120 of the transcontinental rail test shipments completed during the year were equipped with special ride recording devices that recorded the lengthwise impacts received by each shipment during the trip to market. This information is used primarily for determining the comparability of the transit handling received by each test shipment. The information obtained with these devices on the time of occurrences of any rough handling or overspeed impacts received by each shipment is also furnished to the Association of American Railroads for handling with the individual railroads involved in each shipment to assist in the purpose of reducing rough handling of all cars in transit.

Upon recommendation of the Transportation Advisory Committee an effort was made during this year to interest the fruit and vegetable industry and the carriers in a program designed to reduce rough handling of produce by employees of shippers, receivers, and carriers. As a result, the United Fresh Fruit and Vegetable Association has published two posters, the theme of one being *This Produce May Be Only Some Other Fellow's Meal, but Brother It's Our Meal Ticket! So Please Handle it Carefully.* Over 10,000 copies of this poster were sold and distributed to shippers and receivers of fruits and vegetables. The other poster, illustrated by a housewife saying she wants her fruits and vegetables fresh with the admonition *If You Abuse 'Em, She Can't Use 'Em!* was recently made available. It is understood that over 5,000 copies have been distributed.

Little progress has been made so far in enlisting the carriers' support for the publication of posters to warn their employees about the need for careful handling of perishable produce. Further endeavors will be made to obtain their active cooperation during the coming year.

STUDIES TO IMPROVE MARKET NEWS AND GRADING SERVICES

When products travel considerable distances from farms to consumers, market news, grading, and inspection services are essential to the efficient operation of the marketing system. These services are the oldest marketing services of the Department. From time to time changes must be made in these services in order that they may most adequately meet current needs. As the Office of the Assistant Administrator for Marketing and the heads of the various market news and grading services come up against problems on which research is needed to find the answers, this Branch is asked to conduct research in these fields.

IMPROVING THE EFFECTIVENESS OF THE WHOLESALE MARKET NEWS SERVICE

Market News on Prices Received by Creameries for Butter

During the year an analysis was completed and a report published on the practicability and usefulness of market news reporting of prices received by creameries for butter. This study was based on an experimental reporting of prices received by creameries in Iowa from September 1949 through September 1950, and was undertaken because of the need for finding a broader basis for reporting butter prices than is available in the terminal markets, where quantities moving through dealer hands in wholesale lots has largely disappeared. The analysis brought out important differences between prices being reported in terminal markets and prices received by creameries. Creameries found use for this new kind of market news information in determining the adequacy of their returns relative to those of other creameries, in bargaining for better selling terms, in setting prices of local butter, in management decisions, and for other practical purposes.

Market News for Dairy and Poultry Products

Four reports were prepared during the year to complete a series of seven reports which list in detail for the first time all the kinds of dairy and poultry market news information being published by markets and areas. These new reports cover shell eggs, live poultry, dressed poultry, and dairy products other than butter and cheese. They show the detailed basis of reporting being used in each market, including class, type, age, color, and kinds of products being reported, degree of processing, weight groupings, size groupings, methods of reporting grades, kinds of packages, size of lot, market level reported (retail, wholesale selling prices, wholesale buying prices, f.o.b.), condition of sale, and point of delivery. A study of the data indicated many opportunities for greater uniformity in market news reporting between markets. These reports have been made available for administrative use in an effort to increase uniformity and hence the usefulness of market reports.

Dissemination of Market Information

Three reports were completed during the year by Iowa State College under a contract to study the effectiveness of different means of disseminating market news to farmers. They are: (1) *What Does the Iowa Farmer Want from Radio Market News?*

(2) *What does the Iowa Farmer Want from Newspaper Market News?* and (3) *How Do Iowa Farmers Obtain and Use Market News?* These studies disclosed that 92 percent of Iowa farm operators listened to daily broadcasts of market news before selling their products. It was found that for selling hogs and cattle, farmers preferred the market news of the interior packing plants and the large terminal markets. When selling grain, farmers wanted grain reports to cover the nearby local points and the large terminal markets. In selling cream and eggs, they preferred market news that would cover their own local conditions. Eighty-six percent of the farmers selling hogs depended more on their radios than upon any other medium for getting hog market information. Sixty-three percent rated radio at the top when selling cattle. A complete summary of market prices, including top, range, and low for all markets, was favored by 69 percent of the farmers. The farmers also indicated a desire to receive information on the grades of products they sold. They indicated that some of the radio programs were too early to be of use to them. These reports are to be published by Iowa State College. They will be available to the Department as a guide in how to get to farmers the kind of information that they want, and will also be available to radio farm directors, newspaper editors, and others interested in improving the dissemination of market news.

Survey of Market News Published in Newspapers

A tabulation was made during the year of all agricultural market news information (private, State, and Federal) carried in the 1,765 daily English-language newspapers in the United States. The results were studied to determine the extent of use that daily newspapers were making of market news and the kind of distribution that was being given to market news from each Federal and Federal-State market news office. It was found that the value of total space devoted to USDA market news averaged \$15,685 a day or about \$5,700,000 a year. Two publications were prepared for use by Federal and State market news reporters and newspaper editors in studying and improving newspaper distribution of market news. One showed the distribution of information from each market news office by States, and the other was a directory of newspapers showing the kinds of market news each newspaper carries.

Feed Market News

A contract was entered into with the University of Arkansas for purposes of developing and testing the practicability of reporting local feed market news information for use by farmers in making production and marketing decisions involving the purchase of feeds. During the year a comprehensive survey of feed dealers was completed to provide a basis for sampling; the difficult problem of classifying a large number of mixed feeds for reporting purposes was satisfactorily worked out; and trial reporting of feed supply condition and prices was undertaken in two principal livestock and poultry feeding areas in the State. This work is being continued.

Market News Reporting of Broilers and Fryers

In response to numerous requests from the poultry industry for improved market news reporting of broilers and fryers, and because this industry has been rapidly changing and growing, a study was undertaken of (1) the accuracy and usefulness of

the information being reported, and (2) the need for changes in the present service, including the reporting of additional information. During the year interviews were completed with about 25 poultry plant operators and buyers, 20 feed dealers, and 50 farmers in the North Carolina producing area, and 30 plant operators and buyers, 30 feed dealers, and 50 producers in the Shenandoah Valley producing area of Virginia and West Virginia. Records on prices paid farmers were gathered from plants and buyers for comparison with market news prices for the same day, and questions were asked of all members of the industry as to the usefulness of present information and the need for additional information. It is planned to continue these surveys in all major broiler-producing areas and to prepare a report on the market news needs in each area.

EXPLORING POSSIBILITIES FOR DEVELOPING USEFUL RETAIL MARKET NEWS SERVICES

During the year an analysis was completed and a report published on the uses of retail market news as an aid in marketing. This analysis was based on experiences of conducting an experimental retail market news service in Baltimore, Md., for the period July 1949 through December 1950, and on the experiences of State and city governments in reporting retail market news in Boston, Providence, New York, and Baltimore. It was concluded that for such cities, all of which have a large proportion of small stores, the reporting of retail market news was a worth while marketing aid.

The analysis showed that there were many and sometimes large maladjustments between retail and wholesale prices. These maladjustments made it impossible to determine the complete marketing picture from wholesale market news reporting alone. They also impaired the effectiveness with which marketing is done. Some of these maladjustments were as follows:

1. The retail prices frequently failed to adjust adequately to price reductions made by wholesalers and producers, and as a result there was no incentive for consumers to increase their purchases, and supply conditions were not relieved. The homemaker at the same time was not getting as much for her money as she should have received.

2. Occasionally when strengthened demand caused prices to rise at retail, these increases were not reflected in higher wholesale prices. Under such conditions the incentive needed to attract increased supplies into the city was lost.

3. The retail mark-ups over wholesale prices were such that some commodities were required to pay the cost of marketing others. This practice sometimes misdirected consumer attention away from those items in relatively large supply to those items in relatively short supply.

It was found that when retailers, wholesalers, processors, shippers, farmers, and homemakers were provided with retail market news, each used the information in his own interest in ways that brought about over-all economic improvements, lower marketing costs, and important reductions in these maladjustments in marketing.

Eighty-four percent of the retail grocers in Baltimore used the retail market news reports which were sent to them. With the report they were better able to keep up to date with competitive price changes on the large number of commodities they handled and to keep retail prices more nearly in line with wholesale prices. They were better prepared to determine what price they could afford to pay and still sell competitively.

Fifty-five percent of a representative sample of homemakers were sufficiently interested in doing a better job of food buying to make use of the retail prices and "best-buy" information supplied them. As a result of the information in the reports these homemakers substantially increased their purchases of the items that were currently better values as compared with homemakers not receiving the retail reports.

Forty-nine percent of Baltimore wholesalers, 39 percent of processors, 28 percent of shippers to Baltimore, and 4 percent of Maryland and Virginia farmers who received the report said they used the information sent them.

It was found that it cost approximately \$21,000 a year to report accurate retail prices on a large number of commodities in a city of the size of Baltimore. This cost is comparable with or lower than that for reporting wholesale market news on the same number of commodities. Instead of the daily reports which are usually needed for wholesale reporting, weekly reports can be used satisfactorily in retail reporting. Instead of having separate market news services for each commodity group, as is usually done in reporting at wholesale, it is more effective in reporting retail market news to have one reporter in charge of gathering the information on all commodities.

WORK ON GRADES AND STANDARDS

In cooperation with Production and Marketing Administration officials responsible for the promulgation of U. S. standards, a review and analysis were made of the principles and practices followed by the Department in the development of standards for grades for agricultural products. Special attention was given to the suitability of these principles as related to recent changes in methods of marketing. A report was published which set forth for the first time these principles and practices of the Department as a whole.

A survey pretest was made of the extent of consumer understanding of U. S. grade terms on agricultural products. It was found that although there was some uncertainty expressed by housewives as to whether *choice* or *prime* grade of meat was the highest, the majority correctly named *prime*. In canned foods, however, the majority said they thought *choice* was the highest grade and incorrectly rated it over *fancy*. On fresh fruits and vegetables the majority of homemakers incorrectly rated grade *No. 1* as being higher than *fancy*. There was a distinct preference for the numbers 1, 2, 3, and 4 over letters or terms in indicating grade steps; however, none of the homemakers liked the number scores used for butter, 89, 90, 92, and 93. This pretest indicated that more attention needs to be given to the problem of naming grades for agricultural products if they are to be better understood by consumers.

There are approximately 400 standards for grades of individual products now promulgated by the U. S. Department of Agriculture, and these standards are constantly being revised and changed to keep them up to date. A directory, prepared in 1948, listing all these standards and the terms used to indicate each grade step in these standards was brought up to date during the year. It was found that in the changes in designation of grade steps, more letters and fewer numbers and terms were being used, and that there has been a reduction in the number of grade steps.

RECENT PUBLICATIONS OF THE MARKETING AND FACILITIES RESEARCH BRANCH

1. The wholesale market for fruits, vegetables, poultry, and eggs in Jackson, Miss.
2. The wholesale market for fruits, vegetables, poultry, and eggs in New Haven, Conn.
3. Supplement to a report entitled "The wholesale market for fruits, vegetables, poultry, and eggs in New Haven, Conn.
4. The wholesale fruit and vegetable market of Miami, Fla.
5. The wholesale fruit and vegetable markets of Tampa, Fla.
6. The wholesale markets for fruits, vegetables, poultry, and eggs in Atlanta, Ga.
7. The wholesale market for fruits, vegetables, poultry, and eggs in Hartford, Conn.
8. The wholesale market for fruits, vegetables, poultry, and eggs in Columbus, Ohio.
9. The wholesale market for fruits, vegetables, poultry, and eggs in Baton Rouge, La.
10. The wholesale market for fruits, vegetables, poultry, and eggs at Richmond, Va.
11. The Benton Harbor fruit market at Benton Harbor, Mich.
12. The wholesale market for fruits, vegetables, meat and meat products, poultry, eggs, and other produce at Houston, Tex.
13. The Columbia, S. C., produce markets.
14. The wholesale markets for fruits, vegetables, poultry, and eggs at Greenville, S. C.
15. Concentration markets for fruits and vegetables in Sumter and Lake Counties, Fla.
16. The wholesale produce market at St. Louis, Mo.
17. The wholesale markets for fruits, vegetables, poultry, and eggs in Greater Little Rock, Ark.
18. The wholesale produce market at Milwaukee, Wis.
19. The wholesale market for fruits, vegetables, poultry, and eggs at Savannah, Ga.
20. The wholesale markets for fruits, vegetables, poultry, and eggs at Tulsa, Okla.
21. The wholesale produce market at Indianapolis, Ind.
22. The Raleigh, N. C., produce markets.
23. The wholesale produce market at Norfolk, Va.

24. East Texas produce markets and plans for new markets at Tyler and Jacksonville, Tex.
25. The wholesale produce markets at Boston, Mass.
26. Wholesale market for fresh fruits, vegetables, poultry, and eggs in Louisville, Ky.
27. The wholesale produce market at Huntington, W. Va.
28. The Central Retail Food Market of Cleveland, Ohio
29. The wholesale produce market at Winston-Salem, N. C.
30. The wholesale produce market at Nashville, Tenn.
31. The San Antonio, Tex., produce markets
32. The wholesale produce market at Asheville, N. C.
33. Marketing facilities for farm and related products at San Juan, Puerto Rico
34. The wholesale produce market at Beckley, W. Va.
35. The wholesale produce market at Waco, Tex.
36. Some plans for new market facilities for the wholesale handling of produce in Philadelphia, Pa.
37. The wholesale produce market at Toledo, Ohio
38. The relation between locker plants and home freezers in the distribution of frozen foods in Arizona, Part 1
39. The relation between locker plants and home freezers in the distribution of frozen foods in Arizona, Part 2--Quantity buying for home-freezer storage
40. Farmers' produce markets in the United States, Part I--History and description
41. Farmers' produce markets in the United States, Part III--Shipping point fruit and vegetable markets
42. Marketing frozen foods--facilities and methods
43. Planning a wholesale frozen food distribution plant
44. Factors to be considered in locating, planning, and operating country elevators
45. Wholesale poultry and egg markets in 30 cities
46. The comparative efficiency of various arrangements of railroad tracks at stores in wholesale produce markets
47. How fresh fruit and vegetable distributors can get more out of their materials--handling equipment
48. Use of recording and transcribing equipment in loading delivery trucks of produce wholesalers.
49. An analysis of some methods of loading out delivery trucks of produce wholesalers

50. The comparative efficiency of current methods and types of equipment used for receiving field boxes of apples at storage houses in the Pacific Northwest area
51. A portable mechanical lift for high-piling and breaking out high-piled boxes of apples
52. An improved method of stacking standard density bales of cotton in "cordwood" arrangement
53. A comparison of two-wheel hand trucks and clamp-type industrial trucks for transporting uncompressed bales of cotton from blocked area to dinky press
54. An evaluation of the use of the portable platform dial scale for weighing operations in cotton warehouses
55. Some improved methods for receiving bales of cotton in compresses and warehouses
56. Some improved methods of handling groceries in self-service retail food stores
57. The check-out operation in self-service retail food stores
58. Methods of handling and delivering orders used by some leading wholesale grocers
59. How some wholesale grocers build better retailers
60. Marketing Florida prepackaged sweet corn
61. Prepackaging apples at point of production
62. Prepackaging spinach and kale
63. Retailing prepackaged meats
64. The costs of and reasons for rewrapping prepackaged meats
65. Consumer buying practices and preferences for purchasing oranges by weight or count, in selected cities
66. Package and bulk selling of Florida oranges
67. Merchandising reconstituted frozen concentrated orange juice through the use of mechanical dispensers
68. Test of refrigerator car equipped with split-absorption system of refrigeration
69. Test of a refrigerator car equipped with dry ice system of refrigeration
70. Transportation of frozen citrus concentrate by railroad and motortruck from Florida to northern markets
71. Transportation test of dry ice refrigerated truck trailer--Florida to Chicago--May 1951
72. Report of tests on transportation of frozen poultry with mechanically refrigerated trucks (an interim report)
73. The transportation and handling of grain by motortruck in the Southwest

74. A comparative study of packing, transportation, and refrigeration costs of bushel baskets and wire-bound boxes for transportation of peaches
75. Reduction of loss and damage in rail transportation of shell eggs by improved loading and bracing
76. Loss and damage in rail transportation of watermelons
77. Reduction of cantaloup loss and damage in rail transportation through use of the upright loading method (an interim report)
78. Comparisons of transit damages, loading time, and materials costs under various methods of loading cantaloups, 1951 (an interim report)
- *79. Program analysis--improving the effectiveness of wholesale market news services
- *80. The market news reporting job
- *81. Improving the reading ease of market news reports
82. The market news services of the United States Department of Agriculture
- *83. Uniform terminology for all market news services
84. Prices received by Iowa creameries for butter (weekly report, issued during period September 1949 to September 1950)
85. Terms used in livestock market news
- *86. Program for development of the market news service
- *87. Summary of a proposed program for development of the market news services
- *88. The relative prices paid creameries for 91 score and 90 score butter
89. Use of USDA livestock market news by northeastern slaughterers
90. Extent to which receivers of mimeographed livestock market reports also use livestock reports in newspapers and over radio
91. Types of dairy and poultry market news information reported by markets and areas--
 - Part I - Butter
 - Part II - Cheese
 - Part III - Shell eggs
 - Part IV - Frozen and dried eggs
 - Part V - Live poultry and rabbits
 - Part VI - Dressed poultry
 - Part VII - Dairy products other than butter and cheese
92. Reporting butter prices received by creameries (September 12, 1949, to January 22, 1950)
93. Market news reporting of butter prices received by creameries
94. What does the Iowa farmer want from radio market news?
95. What does the Iowa farmer want from newspaper market news?
96. Daily newspapers carrying USDA and Federal-State market reports

97. Use made of market news by daily newspapers
98. A national sample for retail market news
99. Retail market report for Baltimore (weekly report, issued during period July 1949 to December 1950)
100. Baltimore frozen food survey (monthly report, issued during period September 1949 to August 1950)
101. Retail and wholesale prices and price changes for fresh fruits and vegetables, Baltimore, Md. (weekly report, issued during period March 1950 to December 1950)
102. Retail market news as an aid in marketing
103. The market information needed on frozen food
104. List of terms used to designate U. S. grades
105. Relationships between USDA standards and Federal specifications for dairy products
106. Grade terminology used in USDA standards
107. Index of USDA standards for agricultural commodities
108. Variations in State standards and grades for eggs
109. Potential market outlets for mohair

